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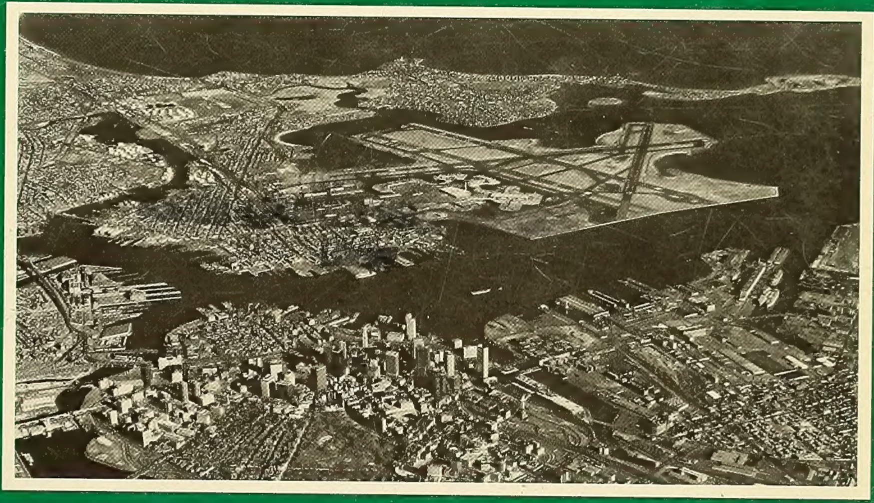
Final Environmental Impact Statement and Final Section 4(f) Evaluation

Third Harbor Tunnel, Interstate 90/ Central Artery, Interstate 93



Boston, Massachusetts

Appendices

Federal Highway Administration
Massachusetts Department of Public Works

August, 1985

FOREWORD

Appendices is one of five separately bound reports which constitute the Final Environmental Impact Statement/Environmental Impact Report package for the Third Harbor Tunnel/Central Artery Project, as listed below.

1. Final Environmental Impact Statement/Report (Two Volumes)

2. Public Hearing: Synopsis of Testimony, Responses to Verbal Comments, Transcript

3. Supportive Engineering Report

4. Appendices

5. Two-Lane Tunnel/Optional Fort Point Channel Concepts

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PUBLIC PARTICIPATION PROCESS

1.0 INTRODUCTION

The purpose of public participation activities during the preparation of this Environmental Impact Statement and Report was to discuss the various alternatives and corresponding impacts. Public participation activities also served to satisfy participatory requirements of the National Environmental Policy Act (NEPA).

The various activities that were conducted included a Working Committee, a newsletter, field offices, open houses, and information dissemination. Activities that occurred prior to June 1983 are documented in Appendix 2 - Public Participation Process - Draft Environmental Impact Statement and Report (DEIS/EIR) December 1982, and Appendix 2 - Public Participation Process - Supplement to the Draft Environmental Impact Statement and Report (SDEIS/EIR) June 1983.

Since June 1983, there have been two Working Committee meetings, five community informational meetings, and two public hearings. These are discussed below.

2.0 WORKING COMMITTEE

During June 1983 the project Working Committee met twice to discuss the impacts of Alternatives 3A, 5A, and 6. As with other Working Committee meetings, these were held at 27 School Street in Boston, beginning at 7:30 p.m. The meetings occurred as follows.

1. Date: June 13, 1983
   Attendance: 63
   Agenda: Construction staging and costs, relocation impacts, traffic impacts, air quality impacts, noise and vibration impacts.

2. Date: June 27, 1983
   Attendance: 70
   Agenda: Water quality impacts, land use impacts, neighborhood impacts, archaeological and historical impacts, urban design and visual impacts, Section 4(f) parkland impacts, and economic impacts.

The minutes of these meetings are included in this Appendix. There were no Working Committee meetings subsequent to publication of the SDEIS/EIR.

3.0 PROJECT NEWSLETTER

A project newsletter, In Brief, was published on July 1 and contained a summary of all the build alternatives as well as a discussion of the corresponding impacts. Five thousand copies were printed; copies were mailed to over 800 individuals, and additional copies were distributed to agencies and community organizations.

4.0 FIELD OFFICES

Two field offices were maintained during the month of June 1983, at 38 Chauncy Street in downtown Boston, and at the South Boston Branch Library (646 East Broadway, South Boston). At these offices, which were staffed twice a week, drawings of Alternatives 3A, 5A and 6 were exhibited. Since there was very little public activity at these offices, at the request of the Commonwealth's Executive Office of Transportation and Construction, the field offices were closed on 14 July 1983 in favor of the five community informational meetings. Extensive displays and graphic materials were prepared for these meetings.

5.0 COMMUNITY INFORMATIONAL MEETINGS

Five community informational meetings were held prior to the public

hearing in order to acquaint neighborhood residents with the contents of the DEIS/EIR and SDEIS/EIR. Approximately 560 persons attended the informational meetings, which included presentations on the No-Build and six Build Alternatives 3, 3A, 5, 5A, 5A Modified, and 6, and questions and answers on impacts of the alternatives. The meetings were held on the dates and in the communities indicated below:

1. July 28, 1983 - South End/Chinatown

2. August 1, 1983 - East Boston

3. August 1, 1983 - South Boston

4. August 2, 1983 - North End

5. August 3, 1983 - Waterfront

These meetings were publicized through a mailing to more than 800 individuals and agencies as well as in display advertisements in the following newspapers: South End News, Bay State Banner, South Boston Tribune, East Boston Press, East Boston Community News, and Post Gazette.

Sample display advertisements and minutes of the community informational meetings are included in this Appendix.

6.0 PUBLIC HEARINGS

The public hearing on the DEIS/EIR and the SDEIS/EIR was held on August 8 and 9, 1983 at Faneuil Hall, Boston. More than 550 people attended the two days of hearings; more than 120 people gave testimony.

On each day, brief presentations were given describing the project. Two 11'x 14' colored axonometric drawings were on display for reference as were 100-scale colored engineering drawings of each alternative. Summaries of the SDEIS/EIR; newsletters, an informational letter from Massachusetts Department of Public Works (MDPW) Commissioner Tierney, and a form for submitting written comments were distributed to people as they entered the hearing room. Members of the consultant team were available to answer questions regarding the project. Complete sets of the DEIS/EIR (main volume plus 11 Technical Appendices and Supplemental Reports) and the SDEIS/EIR (main volume plus 11 Technical Appendices and Supplemental Reports) were available for reference by those attending the hearing. Copies were also available to individuals upon request.

7.0 DISTRIBUTION OF DEIS/EIR AND SDEIS/EIR

The DEIS/EIR, dated December 1982, was filed with required Federal, State, local, and private agencies and individuals in January 1983. Notice of availability of the DEIS/EIR was published in the Federal Register on February 4, 1983 commencing a 60-day public review and comment period. Its availability was also published in the Environmental Monitor on January 24, 1983, beginning the State's public review and comment period. During the review period, more than 360 copies of the DEIS/EIR were distributed upon request; during this same period, copies of the Technical Appendices and Supplemental Reports to the DEIS/EIR were also distributed.

In March 1983, the Commonwealth of Massachusetts determined that certain changes to the scope of improvements considered in the DEIS/EIR were necessary. On March 28, 1983, the Secretary of Environmental Affairs issued the Decision on Project Change, which was published in the April 8, 1983 Environmental Monitor. This action included rejecting from further consideration the Railroad Alignment alternatives (2 and 4), addition of three new alternatives involving depression of the Central Artery (Alternatives 3A, 5A, and 6), and a decision to prepare a Supplement to the DEIS/EIR on the new alternatives. At the same time, the Commonwealth elected to keep open the public comment period on the DEIS/EIR.

In June 1983, the Supplement to the DEIS/EIR was published. The SDEIS/EIR was filed with required Federal, State, local and private agencies and individuals in late June and early July, 1983. Notice of Availability of the SDEIS/EIR was published in the Federal Register on July 8, 1983, establishing a 45-day public review and comment period extended to August 22, 1983. The July 11, 1983 Environmental Monitor also included information on the availability of the SDEIS/EIR. During this review period, nearly 500 copies of the SDEIS/EIR were distributed to those who requested copies; Technical Appendices and Supplemental Reports were also distributed upon request.

Copies of the December 1982 and June 1983 reports were also available for review in the documents reference rooms of the Boston Public Library in Copley Square, the East Boston Branch Library, the North End Branch Library, and the South Boston Branch Library.

Minutes of the Working Committee
Third Harbor Tunnel Project EIS/EIR
June 13, 1983

Sixty-three people attended the twelfth meeting of the Third Harbor Tunnel DEIS/DEIR Working Committee held at the office of the Central Transportation Planning Staff (CTPS), 27 School Street, Boston.

Lydia Mercado, Deputy Project Manager for Community Participation opened the meeting at 7:25 p.m. Attendees were welcomed and asked to introduce themselves. Ms. Mercado noted that tonight's meeting was to present information generated in the study. Another Working Committee meeting on the subject will be held on June 27 as described in a recent notice. However, the meeting place has been changed to City Hall, the exact location and time to be announced in a forthcoming mailing. Ms. Mercado thanked CTPS for the use of the meeting space over the past year and noted it was now to be used for office space.

Matthew Coogan, Undersecretary of Transportation and Construction for Project Development, was introduced by Ms. Mercado. Mr. Coogan discussed additional work done on alignments in South Boston and East Boston - the design modifications to 5A. This additional work, carried out by a joint venture of Skidmore, Owings & Merrill (SOM), Sverdrup and Parcel, Vanasse-Hangen, and Planning Innovations, results from issues raised at the Scoping Meeting in South Boston at which residents questioned the Seaport access route as described. Questions were also raised about an alignment through Bird Island Flats (BIF) rather than Jeffries Cove. Massport agreed to fund this parallel study.

Peter Hopkinson, SOM, was introduced by Mr. Coogan. Mr. Hopkinson described the activity on both sides of the harbor under the design modifications. In East Boston, the work would be phased for either a two or four lane tunnel and kept to the airline side of the blast wall. In Phase 1, a tunnel would go to BIF, nicking a portion of BIF's Phase 3 development parcel. A temporary shelter would be built for commuter flights. In Phase 2, construction would remain to the east of the BIF access road; the taxiway would remain operable. A temporary Eastern shuttle facility would be built and commuter lines would be relocated to the existing shuttle facility. Eastern's reservation building would be underpinned and some of Eastern's parking would be relocated. In Phase 3, the General Aviation

facility would be taken as well as additional Eastern parking. The temporary shuttle structure would be demolished and both Eastern and commuter operations would return to their original locations.

Mr. Hopkinson continued by saying that in South Boston, the modification extends the alignment east through Commonwealth Flats to the westerly portion of the Boston Marine Industrial Parks' fill area. Since the tunnel would not be in a ship berthing area, it does not need to be as deep at that point, thus allowing for a toll plaza at that location. Ramps also could be designed at this point to facilitate truck access to the industrial areas. Two versions of these ramp connections were shown.

Clark Frazier of SECOT asked about the ramps on East Berkeley Street and keeping trucks off Massachusetts Avenue in the South End. Matt Coogan noted that the area in question was not part of SOM 's study, but added that data gathered for the EIS/EIR indicates that truck problems are on the major roads going from South Boston to Quincy and the Southeast Expressway. There isn't a specific answer for small local roads such as those in the South End. Mr. Frazier said any solution to the problems on large roads must include an examination of the issue of small roads. Mr. Coogan said it was an issue that merited study.

Bill Kuttner, a Boston resident, asked "What were the impacts in Jeffries Cove that the BIF alignment was supposed to answer?" Mr. Coogan stated that a delay in park improvements, construction disruptions, and a ventilation building were all impacts resulting from a Jeffries Cove alignment.

Justin Gray of AIR, Inc. was concerned about the configuration of the ventilation buildings and whether this information would be available at the time of the draft's distribution. He also asked about the impact of the BIF alignment on the Macomber development. Mr. Coogan stated that Massport has entered into a contract with Bolt, Beranek and Newman (BBN) to examine vent stack locations under the design modifications. This information will not be part of the draft EIS/EIR but should be available for the public hearing in late July or early August. Mr. Coogan emphasized that the entire construction process takes place on the airline side of the blast wall, allowing the Macomber BIF development to operate.

Bruce Johnson of Jung/Brannen asked if the 5A modifications would be part of the EIS. Mr. Coogan said yes they would be in raw form; more information would be available at the public hearing.

Mr. Kuttner asked what were the advantages of one South Boston modified ramp alignment over the other. Mr. Coogan said one had a smoother connection than the other.

Len Barbieri, HFMW's Deputy Project Manager for Engineering, was next introduced and presented information on construction staging and construction costs, using Alternative 5A as an example. Mr. Barbieri said that 5A would take 12 years to build with most of that time spent in the central section: the South Boston section to Logan, three years; central section, nine years; North Area, three years. It has been assumed that a third harbor tunnel would be built first to relieve pressure at the Sumner and Callahan tunnels during construction. Some construction would occur concurrently.

Mr. Barbieri noted that utility relocation would take two years. The tunnel portion would take four years with two years allocated to remove the elevated structure. A one year lag time is built into the schedule to allow for contracting; because of the size of the project, five $150 million contracts would be negotiated.

Mr. Barbieri then reviewed the steps in the construction process, describing the slurry wall construction technique and underpinning.

Betsy Johnson of the American Lung Association asked if this breadth of construction work had ever been done before. Mr. Barbieri said the techniques have been used before but never over such a distance.

Paul Mannos, 150 Trust, asked how long it would be before the Anelex Building would be taken. Mr. Barbieri responded that if the project was approved and construction started in 1986, the Anelex Building would be taken at that time for construction staging.

Louise Lewis of the Sierra Club asked how construction could take place on top of the depressed artery. Mr. Barbieri responded that a three to five story building could be built on top of the tunnel without additional reinforcement of the tunnel box. For larger buildings, additional supports and reinforcement must be placed in the tunnel structure at the time of construction or additional foundations would be provided by prospective developers at the time of development. Large buildings are not precluded on top of the tunnel.

Emilie Pugliano of the North End Neighborhood Task Force asked if the project would affect the North Station development and operation of transit and utilities. Mr. Barbieri said the project was evaluated assuming the North Station development. Transit and utilities also were incorporated as constraints in the project.

Mr. Kuttner asked why the tunnel box/wall couldn't be put in first. Mr. Barbieri said the construction sequence was constrained by limited headroom and narrow corridor confines.

Mr. Barbieri noted the cost of each supplementary alternative: 3A, $1.9 billion; 5A, $2.2 billion; and 6, $1.3 billion.

Justin Gray asked about the implications to the Sumner and Callahan tunnels during the depression and widening of the Central Artery; would lanes be closed? Mr. Barbieri noted that keeping the existing tunnels and Leverett Circle operating were basic assumptions in the project. During construction, one lane of the tunnels would be closed at a time, with three always open. Mr. Gray said this would reduce capacity and asked if the third harbor tunnel becomes a prerequisite. Mr. Barbieri said yes, it was assumed to be built in the first phase in those alternatives in which it was incorporated.

Ruth Kolodney, an HFMW planner, described relocation impacts of the project. She emphasized that no residences were taken or relocated but a number of businesses would be affected along the construction corridor: under 3A, 23 total or partial reloca- tions affected 94 businesses and approximately 4000 employes; under 5A, 27 total or partial relocations affected 97 busi- nesses and approximately 3400 employees; and under 6, 14 total or partial relocations affected 69 business and approximately 2800 employees.

Ms. Kolodney noted that in the North Area, the Anelex and Charles River Buildings would be taken. The loading area of the Stop and Shop Bakery also would be taken essentially making the business inoperable at that location. Other takings include nine parking lots, Hook Lobster, and the Rapid Service Press Building. Under 3A only, the Customs House Building is taken and the Atlantic Building is a partial taking. Under 5A only, four South Boston manufacturing firms would need to relocate.

Available relocation space varies according to the needs of the tenants. Monetary aid is available to eligible relocated businesses.

Louise Lewis stated that replacing lost parking was not necessary. Mr. Coogan stated that the relocation report only documents what is taken not whether it should be replaced.

Emilie Pugliano noted that the Coast Guard is redoing space on Commercial Street. Was this sufficient to house the Coast Guard operation displaced from the Anelex Building? Ms. Kolodney said it was not.

Bruce Johnson asked if assistance was available for temporary takings. Ms. Kolodney said there is assistance available.

Clark Frazier noted that there are numerous proposals for new parking lots; spaces lost due to the project may come under the city's parking freeze if not replaced within a certain period of time.

John Yaney, HFMW traffic engineer, presented information on traffic projections. Data indicated that under Alternatives 3A, 5A, and 6, more capacity on the Central Artery would mean more traffic carried and less diversions onto local streets. This translates into a reduction of vehicle miles traveled and an increase in energy saved. The hours of vechicle miles traveled is decreased under these alternatives due to increased capacity, thus travel time is reduced.

Mr. Yaney noted that under any of the third harbor tunnel alternatives, the hours of congestion at the Sumner/Callahan tunnels in 2010 would be reduced from 14 hours to zero or one hour. The largest reduction in accidents in 2010 would occur under Alternatives 3A and 5A.

Clark Frazier stated that assumptions upon which the numbers were produced must be documented. He said certain things about development and parking have been assumed which may not be consistent with policy. Mr. Yaney said all assumptions have been documented by CTPS.

Mr. Frazier asked about the project's impact on transit ridership. Mr. Yaney responded that transit ridership to Logan Airport would decline over what it would be if there was no increase in highway capacity by approximately 12,000 trips per day; this includes all modes of transit such as taxis, and the Blue Line. Justin Gray asked how many trips that would be per year. Mr. Yaney said it would have to be calculated.

Tom Lisco, CTPS, noted that since 1970 there has been a decline in air passenger use of the tunnels because of increased congestion. Projections were based on the assumption that the transit system to the airport remains the same as today.

Louise Lewis said that limited access ramps should be examined to improve traffic in Boston. Mr. Yaney responded that increased capacity on the Central Artery will tend to reduce diversion trips and, therefore, improve traffic generally. Ms. Lewis emphasized that the design must reduce traffic in Boston to which Mr. Yaney stated that limiting traffic on local streets is a prime concern of the project. Ms. Lewis added that there shouldn't be additional traffic on New Sudbury Street, traffic must be controlled.

Neil Fitzpatrick of Boston Freight Terminal asked if there would be rerouting of trucks during construction. Mr. Yaney said there would be staged traffic rerouting but extensive traffic rerouting in South Boston is not expected. Temporary roads and bridges bypassing construction will be built when necessary.

Mr. Kuttner asked if lanes could be added to the elevated Central Artery. Mr. Yaney said that situation was being examined but severe problems result from construction impacts and takings in the Dewey Square area. Mr. Coogan added that this widening was examined but that the Federal Highway Administration has stated it should not be evaluated to the level of an alternative and that it was basically a dead option.

Clark Frazier asked about proposed decking of the Southeast Expressway, that work in this area must be evaluated in an EIS. Mr. Coogan responded that a traffic management lane is included in that area and that this section of the Southeast Expressway is included in the EIS. Mr. Frazier continued by saying that the Massachusetts Avenue bridge should be examined in the study, that a three lane bridge should not be rebuilt and the existing bridge should be torn down. According to Mr. Frazier, this would rationalize the system, encouraging trucks to avoid Albany Street and local streets. Mr. Coogan responded that reconstruction of that area is going head; the issue is not included in this EIS. It is a question which needs to be answered but not in this study.

Meng Chng of Bolt, Beranek & Newman was next introduced and made a presentation on air quality impacts. Mr. Chng noted that the Central Artery depression would not cause a violation of the one hour carbon monoxide (CO) limit. The effects of the

depression on eight hour CO would be small but a new tunnel would show dramatic improvement in eight hour CO concentrations. In East Boston, a new tunnel would result in more diffusion and shortened queues causing a drop in eight hour CO and one hour NO2. No air quality problems are anticipated in the new tunnels under design conditions.

Mr. Chng continued by saying that far field analysis of the ventilation buildings showed no problems in general although the North End would experience some increase in pollution under Alternative 6. Near field analysis showed pedestrian and air intake problems at each stack. Traffic disruption during construction may make the city's existing eight hour CO problem worse, and add more dust to the air.

Mr. Chng reviewed mitigating measures which include traffic management, by pass routes, dust control, multiple vent buildings, siting, and changing vent building height.

Mr. Frazier stated that Copley Square will be affected by increased capacity on the Central Artery and that any nitrous oxide increases are bad. Betsy Johnson of the American Lung Association noted that NO concentration will increase as more diesel vehicles are put on the road. Mr. Chng responded that the level of NO used in the study - 320 micrograms - was the state standard and is much more stringent than EPA's proposed level. He agreed that the level is still in a state of flux. Mr. Chng added that all emissions analysis reflect an increased rate of use of diesel fuel.

Mr. Chng concluded by saying Copley Square was outside of this project area and was being examined in a separate study. Mr. Frazier said it would be impacted and needed to be studied.

Justin Gray asked how the height of ventilation buildings could be a mitigating measure. Mr. Chng said raising the source affects the dispersal pattern.

David Towers of Bolt, Beranek & Newman presented noise and vibration impacts. Mr. Towers said there would be a reduction of noise and vibration under Alternatives 3A, 5A, and 6 along the Central Artery. During construction, there would be an increase in noise at the Massachusetts Rehabilitation Hospital and the Tea Party Museum under Alternatives 3A, 5A, and 6 and at Stillman Place under these alternatives plus Alternative 1. Construction related vibration would cause annoyance at Stillman Place under all alternatives. Construction vibration would also disrupt Gillette Company's water intake pipe for approximately one month.

Mr. Towers discussed various mitigating measures which include modifying construction techniques, shields, and scheduling.

Peter Athens of A.D. Little asked what were the sources of the levels of vibration. Mr. Towers responded that the Copley Place project and measured levels from other projects for similar soil conditions were examined; all sources are documented in the report.

Emilie Pugliano asked if records on water level changes and vibration impacts exist from the Central Artery's construction. Mr. Towers was not aware of any but Gordon Slaney, Project Manager, added that while no records exist for vibration some records of construction exist and were used for construction staging.

Mr. Slaney reminded the Committee of the June 27 meeting, noting that the location will be changed; notice of the new location will be sent by mail.

The meeting was adjourned at 9:50 p.m.

Mr. Carl Byers, Community Planning and Development Officer, H.U.D., (15 New Chardon Street) requested a set of reduced scale staged construction drawings.

Working Committe 6/13/83

Please Sign In

Name	Address and/or Organization
Joseph Rubino	Harding Co.
Philip Caruso	Boston Traffic & Parking Dept.
Richard Mori	Gr. Boston Chamber of Commerce
Mary Konsoulis	HFMW
John Yaney	"
Lydia Mercado	"
John Mahoney	Sverdrup & Parcel and Associates
Eric Savolainen	GSA - Planning Staff
Bill Kuttner	199 Mass. Ave. #20, Boston, MA 02109
Arthur Brooks	P.O. Box 442, Boston, MA 02130
Chris Menge	50 Moulton St., Cambridge BBN
Dave Towers	BBN
Paul Mannos	150 Trust 150 Causeway St.
Wendy Landman	HFMW
Patricia Coogan	243 North St.
E. Leo Lydon	MDC
Edward Demone	1 PCT GSA Design & Const. Br.
Franklin V. Montford	National Park Service, 15 State St.
Hugh D. Gurney	" " " " " "
Betsy Johnson	ALA-Boxton 263 Summer St. Boston, 02210
Carole O. Sonduck	LWV Mass.
Kevin Haley	125 High St., Meredith & Grew Inc. 02110
Peter Athens	A.D. Little, Inc.
Carol Schlessinger	HFMW
Matthew Coogan	EOTC
Gordon Slaney	HFMW
Len Barbieri	HFMW
Meng Chng	BBN
David Towers	BBN
Peter Hopkinson	SOM
Karen Alschuler	SOM
Skip Smallridge	HFMW
Tom Lisco	CTPS
Tony DiSarcino	Sega, DiSarcino Assoc.
Tom Ennen	Boston Harbor Assoc.
Norman Faramelli	Massport
Sy Mintz	BSA
Gulab Hira	Gillette
Carl Byers	HUD
Donna Rososco	Massport
Ann Hershfang	EOTC
Anthony Centore	PBQ & D, 120 Boylston St., Boston
Judy Greenspan	BOSCOM, 40 Broad, Boston
Alfred Vesperi	BCS, 31 Fargo St., So. Boston
Neil Fitzpatrick	Boston Freight Terminals, 31 Fargo St.
Karl Christ	Gillette Pk. S. Boston, Gillette

Working Committe 6/13/83

Please Sign In

Name	Address and/or Organization
A.M. Termine	Gillette - Park - Gillette
Steve Poulos	Winchester, Geogtechnical Engrs.
Michael P. Manning	251 "L" St., S. Boston
Paul McDonough	527 E 8th St., S. Boston
Alan Radding	Tunnel Radio, 186 Lincoln St., Boston
Carolyn Ellis	152 Milk St., Boston
John Sheehan	Boston Public Work, City Hall
Clark Frazier	South End Committee on Transp., South End
Emilie Pugliano	North End Neighborhood Task Force
Justin Gray	1791 Beacon St., Waban, MA 02168/AIR, Inc
Alice Madio	Museum Wharf
Oliver Gillham	SOM, 8355 Boylston, Boston
Louise Lewis	Sierra Club, 97 Newbury St., Boston
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Bruce Johnson	Jung/Brannen, 177 Milk St., Boston
Robert Kenney	Boston Wharf, 259 Summer St.
Susan Houston	CC&F, 60 State St.
AB Casendino	CBT, 306 Dartmouth St., Boston
Joel Brown	SWEC, P.O. Box 2325, Boston, MA

MINUTES OF THE WORKING COMMITTEE

THIRD HARBOR TUNNEL/DEPRESSED CENTRAL ARTERY EIS/EIR

27 JUNE 1983

Seventy people attended the thirteenth meeting of the Third Harbor Tunnel/Depressed Central Artery DEIS/DEIR Working Committee meeting held at Boston City Hall, Room 801.

Lydia E. Mercado, Deputy Project Manager for Community Participation opened the meeting at 7:25 p.m. She announced that this would be the last meeting of this group prior to the public hearings which would take place during the second week of August. Those present introduced themselves. Ms. Mercado then reviewed the three supplementary alternatives indicating that Alternatives 3A and 5A include a depressed central artery with tunnels to the airport (one from Fort Point Channel and another through South Boston) and Alternative 6 is a depressed central artery only.

Gordon Slaney, Project Manager for HFMW, a joint venture, indicated that the Supplementary DEIS would be printed this week and would be available sometime next week. He stated that the purpose of tonight's meeting was to continue presenting the impacts of the three supplementary alternatives.

Mr. Carl Noyes of Jason M. Cortell Associates discussed the water quality characteristics of the existing project area. For the supplementary alternatives, the areas covered include water quality, analysis of sediment and vegetation, and wildlife. He indicated that three borings were done in the vicinity of Commonwealth and Fish Piers. He compared the number of work days required to dredge for a Third Harbor Tunnel (210 working days for Alternative 5A and 250 days for Alternative 3A) and the amount of sediments to be dredged by alternative: Alternative 3A would take 2,737,000 cubic yards, Alternative 5A would take 3,340,000 cubic yards, and Alternative 6 would take 240,000 cubic yards. In addition, bentonite slurry would need to be disposed of as would excavated material from the Central Artery section of the project. Mr. Noyes also discussed excavate disposal, pollution changes caused by the tunnels, and the effects to industrial water users in Fort Point Channel. In Fort Point Channel there would be a 37% reduction of the tidal prism; in Alternative 5A, a 40% reduction would result in a change in tidal finishing from 2.1 to 2.5.

Clark Frazier from the South End indicated that there is a problem with salt water intrusion into basements in the South End and asked whether there would be any increased risk during construction.

Mr. Noyes indicated that there might be some risk when the two structures are combined (referring to the Roxbury Canal conduit and the tunnel).

Mr. Frazier asked who would pay for damages if flooding occurs?

Emilie Pugliano from the North End recalled that when the Central Artery was built the water table changed and water began to go into cellars; all landlords had to install pumps. This time the possibility of flooding should be carefully monitored.

Betsy Johnson asked whether water resource impacts would change with Alternative 5A Modified.

Mr. Noyes answered that there would be more land-based excavate material and less dredging.

Mr. Slaney added that all impacts will be assessed for the selected alternatives.

Michael Reiskind asked what will happen to the water table during construction. Len Barbieri answered that the slurry wall method of construction had been selected for its ability to maintain the water table.

Wendy Landman, HFMW Planner, presented land use and community facilities impacts. Regarding Alternative 1 or No Build, she indicated that the long-term impact will be increased congestion, and decreased access to Logan Airport. The Central Artery will continue to be a barrier in the Financial District/Waterfront. Redecking of the artery will not cause any changes in land use.

Alternative 3A will increase regional accessibility. There will be no change in housing. Approximately 20 acres of land will be created; development of this land will have to be regulated by local and state authorities. During construction there can be some delays in development. The sequential closing of bridges (in Fort Point Channel) will impact businesses and museums during these periods. Fort Point Channel will have improved access which is beneficial to certain types of development, but not beneficial to others. In the West End there are no changes in land use. In Logan Airport it is expected that there will be changes in the location of certain uses but not in the uses themselves.

Alternative 5A will have similar impacts in land use as Alternative 3A in the Central Artery area. In South Boston it will affect the type and timing of development, particularly in these parcels where development may be constrained by subsurface easements (includes properties of Boston Wharf Co., the U.S. Post Office, Harding Co. and Massport).

Regarding neighborhood impacts, under Alternative 1-No Build, traffic congestion in East Boston and South Boston is expected to increase. Alternative 3A is expected to have the following impacts: in the South End, no impacts are anticipated; in South Boston, there will be a need for stringent traffic management and in the long-term it is anticipated that traffic will improve; in the Waterfront and North End, there will be impacts during construction.

A South End resident asked about the impact of increased traffic on East Berkeley Street. Ms. Landman answered by saying that there was no traffic increase expected on that street.

Clark Frazier wondered where cars will park at Logan Airport. The Park & Fly lots will continue to expand, a situation which is undesirable. Mr. Frazier then asked if roadway capacity is increased, won't transit riders shift to private vehicles? Anything that increases roadway capacity will increase parking demand. It can not be said that there are no impacts in the South End and Back Bay. In the South End, the industrial areas are turning into lofts and there can be expected to be more housing once the elevated is removed. Anything that increases traffic on the Southeast Expressway will increase through traffic.

Mr. DiSarcino indicated that this study was not a parking policy for the city of Boston and that Central Artery traffic is not directly related to Back Bay parking. Anthony DiSarcino also indicated that Massport has to study the parking situation at Logan Airport.

Betsy Johnson indicated that if the North Station area remained under construction for five years the Boston Bruins would be impacted.

Ms. Landman indicated that construction staging will be carefully sequenced taking into consideration the various activities nearby.

In response to the question regarding the construction staging of Alternative 5A Modified, Oliver Gilham indicated that it would be done in three phases.

Frederick Gorman from the Institute for Conservation Archaeology presented the archaeological impacts as discussed in the Supplemental Study. The results indicate a high likelihood of locating archaeological sites in the project area. The areas identified were: (1) Mill Pond District, (2) Boston Neck District, (3) Town Cove Area, and (4) Fort Hill. In order to further determine the existence of these sites, a program of excavations has been proposed.

Sy Mintz asked what impact could archaeological findings have on construction staging.

Mr. Gorman indicated that it would take three to five years to carry out the excavation program adequately and that it is difficult to determine what effect it would have on construction staging since there is no comparable site in the city.

Pauline Harrell from Boston Affiliates presented the historical impacts contained in the SDEIS. The project is in the richest historical area of Boston. When the Central Artery was constructed there was drastic damage to this historic area. Now, if the Central Artery is depressed, there will be an opportunity to reknit the area. The survey done by the Boston Landmarks Commission was the basis for determining the historical

significance of buildings within the project area. Included were potentially eligible buildings and districts and both long- and short-term impacts were assessed. The highlights of that study were:

1. The National Register Area of the Charles River Basin District - Marginal impact -- the taking is a 10' wide strip of parking lot;

2. Bulfinch Triangle - Formerly the Mill Pond District. This area will be most heavily impacted by construction of the Central Artery. This area is potentially eligible because of the street pattern and late 19th century industrial buildings.

3. Causeway/North Washington Streets District. There is one taking - the Charles River Stores Building. The building is not potentially eligible, however, the district is. The taking of the Stop & Shop loading dock may impact the viability of the building.

4. The North End as a neighborhood is potentially eligible based on social history more than architectural homogeneity. There is a significant collection of Georgian Revival buildings - mostly public -- the Public Academy, North End Bath House, George R. White Health Unit and Boston Printing Department Plant and the Paul Revere Mall (The Prado). The location of a vent building nearby will impact this area.

5. The Blackstone Block is on the National Register of Historic Places. The Ebenezer Hancock House, the street pattern, Union Oyster House, are all very significant and very fragile and will require very close monitoring during construction.

6. Quincy Market and Faneuil Hall are both on the National Register.

7. The old Waterfront District is potentially eligible.

8. The Customs House/Broad Street District is significant because Charles Bulfinch laid it out and it is in the heart of the Financial District. They all need careful attention during construction, but there is the opportunity to reknit this area with the Waterfront.

9. The Commercial Palace District - there is no significant impact except near Fort Hill.

10. The new U.S. Customs Building is not eligible because it has been altered.

11. Commonwealth and Fish Piers are potentially eligible, however, there is no significant impact.

12. The Fort Point Channel area was reexamined and was considered to be potentially eligible along with Boston Wharf Co. They represent late 19th century industrial and transportation development

of Boston. All bridges on the Channel are eligible (Northern Avenue Bridge is already on the Register). The Fort Point Channel is heavily impacted by almost all the alternatives.

Marcia Meyers asked whether any consideration had been given to locating the northbound lanes of the Central Artery on land instead of the Fort Point Channel.

Mr. Slaney indicated that the consultants had begun to examine the possibility of using Atlantic Avenue.

Skip Smallridge, HFMW Urban Designer, described urban design and visual impacts with the assistance of slides. The Central Artery today is in a tight congested area; it is dark, noisy and shadowy beneath it and constitutes a barrier. If it were depressed, there would be an opportunity to reconnect visually both sides. There would be some open sections/ramps and there is some flexibility regarding the location of vent buildings. The existing artery affords drivers views of the city which assist in orienting them. Once the artery is depressed, drivers would have to rely on good signage for orientation. In the North Station area, there would be some new elements - ramps along the Charles River. The bridges over the river would be lower and should be sensitively designed. In South Boston the shortening of Fort Point Channel is not visually perceptible from summer Street. However, the tunnel box alongside the channel is visually intrusive. Dorchester Avenue on top of tunnel will disallow a sensitive pedestrian pattern. In South Boston, there will be a need for subsurface easements. Putting the Central Artery underground will create 20 acres of land, most of which could be available for joint development. The assumptions for determining the use of this land are:

1. State, city and neighborhood residents will jointly determine the type of use through an open ongoing process.

2. Structurally a maximum of 15 stories could be supported.

3. Parcels should be of a size and configuration to be developable.

Mr. Smallridge showed slides of highways and tunnels in other cities that had joint development over the roadway.

Mr. Frazier asked whether it would be possible to reconnect the buildings that had been severed when the Central Artery was constructed.

Mr. Smallridge said that the surface street as proposed would not allow it.

In response to a question on the possibility of not developing the land, Mr. Smallridge indicated that the concept was not to perceive it as a corridor because it had not been one historically, but open space opportunities are still there.

Mr. Frazier asked whether the existing portion of Dorchester Avenue alongside Fort Point Channel could be reused.

Mr. DiSarcino indicated that the city of Boston had sold it to the Post Office.

Mr. Mintz asked, "Do you only see solutions that address a depressed Central Artery?"

Mr. Smallridge indicated that from an urban design point of view a widened artery would not be good and a partial depression practically impossible.

Susan Houstin, CC&F, asked whether the connector ramps in South Boston could be located elsewhere.

Mr. DiSarcino indicated that such a change could be looked at.

Robert Sturgis of the BSA asked what could be done now at the EIS stage to establish a mechanism for determining the cost and ownership of the newly created land.

Mr. Smallridge indicated that in the North Area project in Charlestown a process was established for determining joint development. The MDPW will own the land and will lease it.

Ms. Meyers asked what mitigating measures were being proposed for the Charles River Basin area.

Mr. Smallridge said that the bridges have to be sensitively designed.

Carole Schlessinger, Planner, HFMW, presented the impacts on parks and designated open space, otherwise known as 4(f) section which includes historical and archaeological impacts. Impacts on the East Boston Stadium and Bird Island Flats Park were discussed previously. Parks affected by the alternatives discussed in the SDEIS are:

1. MDC Charles River Basin Reservation - the area impacted is between the old dam and the Longfellow Bridge. The land in question is currently being used as a parking lot. Construction impacts on this land are a subsurface ramp from Leverett Circle to the Central Artery. Nashua Street will be relocated and will occupy 30'W x 100'L and 20' easement for construction.

2. Paul Revere Landing Park - the MDC has legislation pending to acquire land to convert to park. Viaduct bridges will reduce park, create greater shadows and bring traffic closer to walkways.

Frank Mahady of Economic Research Associates presented the economic impacts. The analysis looked closely at transportation accessibility to the Central Business District (CBD) and the region and the need for improved movement of goods. Alternatives 3A and 5A will improve regional

access to Logan Airport. Hi-tech need good, fast access to the airport; access is also important to the financial industry, freight forwarding and emergency hospital services. Alternative 1-No Build - will have a dampening influence on CBD.

Alternative 6 will be most disruptive during construction. Alternative 5A will be least disruptive during construction. Alternative 1 will be most disruptive during redecking.

Retail sales losses can be expected to be 2%-5% during construction. Tourism and entertainment will be impacted as a result of parking reduction. Quincy Market may see a 10% loss in sales as a result of parking reduction.

Rowes & Fosters Wharf will experience a 1-1/2 to 2 year delay. South Boston parcels will be developed sooner because the tunnel will be built first.

Mr. Frazier asked about the financial impact on the MBTA.

Mr. Mahady said that there is not expected to be a great impact on the MBTA since primary beneficial impact will be on movement of goods and not on people.

Ms. Meyers asked about the difference between Alternatives 5A and 5A Modified.

Mr. Mahady answered that 5A Modified is better from an economic point of view.

The meeting was adjourned at 10:45 p.m.

ATTENDANCE
27 June Meeting

NAME	ADDRESS and/or ORGANIZATION
Leonard Barbieri	HFMW
Frank Leathers	Geotechnical Engineers Inc., 1017 Main Street Winchester, MA 01890
Leo E. Stryker	789 East Broadway, South Boston 02120 Boston Educational Marine Exchange
Wendy Landman	HFMW
Lydia Mercado	HFMW
John M. Shuber	Boston Public Works
Philio D'Alessandro	OSTA
Steven R. Berhe	1 Longfellow, Apt. 2921, Boston
F.N. Manford	National Park Service
Web Bingham	739 Boylston, ERA
Judy Greenspan	BOSCOM, 40 Broad Street, Boston
W. Gary Atkinson	The Beacon Companies
Robert B. Shuyin	Boston Soc. of Arch., 2 Central Sq., Cam
Ken Sinkiewicz	Michael Taylor/Boston City Council
Patricia Sullivan	Paul Revere House, 19 North Sq., South Boston
Dana P. Narlee	Peter Elliot & Co., 126 High Street, Boston
Carlton Noyes	JMCA
Steve Poulos	Geotechnical Engineers Inc.
Karl Christ	Gillette Speedy Razor
Kevin Feeney	General Services Administration
B. Johnson	Jung/Brannen
Sidney Fruman	Castle Metal Co., 464 Albany Street, Boston
Budge Upton	CC&F
Carl Byers	HUD
Carole O. Sondrick	LWV Mass, 320 Park Avenue, Arlington 02174
Byron Rushing	State Representative - 9th Suffolk
Pauline Chase Harrell	Boston Affiliates
Alice Boelter	Massport
Dorothea Hass	Boston Affiliates
Adel Foz	WFA
Linda Ross	WFA
Gordon Brigham	WFA
William Mandeville	Eastern
Carol Gladstone	TBC, 1 Post Office Square, Boston
Pat Wells	Boston Educational Marine Exchange
Cornelia Patten	Citizens Housing & Planning Assoc.
Charles Crooks	Boston Arch. Ctr., 85 Comm Ave, Chestnut Hill
Fred Gorman	ICH
Skip Smallridge	HFMW
Bill Oliver	MDPW
Tom Maisteos	HFMW
Arthur Brooks	P.O. Box 442, Boston 02130
Anthony DiSarcino	HFMW Consultant
Carole Schlessinger	HFMW

ATTENDANCE
27 June Meeting

NAME	ADDRESS and/or ORGANIZATION
A.C. Shippee	U.S. Postal Service, Boston
Betsy Johnson	ALA of Boston and LWV of Boston
Clark Frazier	SECOT; BAPCC
Oliver Gillhan	SOM, 334 Boylston Street, Boston
David Sandly	MSA, 15 Court Square, Boston
Gordon Slaney	HFMW
Michael Reiskind	100 Rockview Street, Jamaica Plain
Marcia Meyers	Boston Landmark Commission
Rupert Davis	Boston Presentation Alliance
Sy Mintz	BSA
K. Chng	BBN
Susan Houston	CC&F, 60 State Street, Boston
Frank Mahady	ERA, 739 Boylston Street, Boston
Enzo Satta	WFA
Peter K. Barber	Northland, 2150 Washington Street, Newton
Jerry Suler	8 Symphony Road, Boston
Emilie Pugliano	20 Parmeter Street, Boston 02113

MINUTES OF THE CHINATOWN/SOUTH END INFORMATIONAL MEETING

THIRD HARBOR TUNNEL/DEPRESSED CENTRAL ARTERY EIS/EIR

28 JULY 1983

Approximately seventy people attended the Chinatown/South End Informational Meeting held at the Quincy Community School, 885 Washington Street, Boston.

The meeting was opened at 7:20 p.m. by Matthew Coogan, Undersecretary of Transportation and Construction. Mr. Coogan explained that this was an informal informational meeting to generate comments from the community; the final public hearings would be held on August 8 and 9. Mr. Coogan noted that comments placed on the record at these hearings must, by law, be addressed in the FEIS. Written comments would be accepted until August 22.

After these introductory comments, Mr. Coogan continued by explaining the history of the project, noting Governor Dukakis' decisions to drop the two East Boston railroad alignments, expand the study to include examination of the Central Artery, and include a Seaport Access alignment through South Boston. Mr. Coogan added that design modifications to Alternative 5A - Full Build with Seaport Access road - have been developed as a result of neighborhood and other requests. Mr. Coogan also said that the Governor and his staff would review all concerns and make a decision regarding a preferred alternative by the project deadline of September 30.

Using slides, Mr. Coogan described the "families" of alternatives - Full Build (3A, 5A, 5A Modified), Tunnel Only (3, 5), Artery Only (6). He also explained that the No Build would, in fact, require redecking of the Central Artery, a construction process that would last three years and would generate impacts during that time. Mr. Coogan noted that widening the existing elevated structure was reviewed at the request of FHWA; it was determined not to be a realistic option in light of its potential to adversely impact Chinatown.

Mr. Coogan then introduced Gordon Slaney, Project Manager. Using slides, Mr. Slaney described the regional impacts of the alternatives.

Leonard Barbieri, Deputy Project Manager for Engineering, was next introduced. Mr. Barbieri described the construction staging process, noting that along the Central Artery, utility consolidation would take two years, construction of the tunnel box four years, demolition of the elevated structure two years, and contracting one year. Mr. Barbieri emphasized that the six lanes of the elevated would be maintained during construction, as would pedestrian patterns and traffic access, and one half of the surface artery would be used as a construction road during the construction period.

Adel Foz, Deputy Project Manager for Urban Design and Planning, was introduced, and described local impacts of the project in terms of "trade-offs". Takings would include the Anelex and Charles River Buildings and the loading area of the Stop & Shop Bakery, all in the vicinity of North Station. The project would, however, allow for the reconnection of the Bulfinch Triangle. Mr. Foz continued by saying that a process needs to be established whereby state, local, and community interests can work together to guide development in the new parcels created along the Central Artery corridor.

Mr. Foz noted a 50% loss of business during construction and some increased traffic on certain streets. In Chinatown, long-term traffic should be less.

The meeting was then opened to questions and comments:

Clark Frazier, SECOT, said that existing highways place too much traffic in the South End; ramps on the Southeast Expressway are badly placed. Mr. Frazier said depressing the Central Artery was a good idea and that Alternative 5A Modified is the only reasonable alternative, but warned that it would place additional traffic on East Berkeley Street. Mr. Frazier stated that Alternative 5A did not have direct access to South Station and the airport.

Matt Coogan responded that the city of Boston is considering a widened road near Herald Street to provide a bypass for Back Bay traffic. The state is also looking at adapting the ramps to widened Herald Street and will also look into transit between the airport and South Station.

Boston City Councillor Fred Langone noted that the South End has a traffic problem because a lot of traffic wants to go between Back Bay and the Expressway. Councillor Langone said that in 1968 Dorchester Avenue was sold to the Post Office with the understanding that a viaduct would be built. However, it was later felt that it could not be built because of the Red Line tunnel. Councillor Langone wondered if it was now safe to build over the tunnel.

Mr. Coogan said that it was safe to build a tunnel over the Red Line; new Dorchester Avenue would also take additional traffic.

Betsy Johnson of the Boston League of Women Voters wondered if the new surface road could be used as a through street.

Mr. Coogan described the basic concept as a local street with traffic lanes - two moving lanes and one parking lane.

Ken Campbell asked if an eastbound entrance to the Turnpike had been explored.

Mr. Coogan said that the geometry was too tight and that there was a question regarding the legality of putting free traffic on a toll road. He added that the state will not fund or include in the study an

examination of Herald Street, but would coordinate with Boston if the city wants to improve the street.

Clark Frazier clarified that the widening of Herald Street will take traffic from Marginal Street.

Fernando Requene asked how the plans of the Boston Educational Marine Exchange for Fort Point Channel will be impacted by the project.

Mr. Coogan responded that the plans focus activity on the South Boston side of Fort Point Channel.

Bill Kuttner wondered if the existing ramp configurations at South Station/Turnpike/Southeast Expressway could be improved.

Mr. Coogan said this area would be looked at further.

Clark Frazier said that the proposed lane configuration at the Massachusetts Avenue interchange prevents the use of the Expressway by trucks, adding that this does not meet interstate standards.

Mary Nee of South Boston expressed concern over the use of South Boston by truck traffic.

Mr. Coogan said there would be no connection between Summer Street to the airport; the design tries to prevent cross-traffic.

The meeting ended at approximately 9 p.m.

ATTENDANCE
Informational Meeting
Chinatown/South End

NAME	ADDRESS and/or ORGANIZATION
Arthur Brooks	P.O. Box 442, Boston 02130
John Yaney	HFMW
Maryann Curtis	31 Worcester Square, Boston 02118
Michael J. Cappizi	245 Newbury Street, Boston
April Jackson	8 Newcomb Street, Boston
Fernando Requene, Pres.	WSANA, 53 E. Concord Street, Boston
Lucy Ferullo	Worcester Sq. Area Neighborhood Assoc., EOTC
Ken Gritter	Ellis Neighborhood Assoc.
Bob Harkness	131 Appleton Street, Ellis N.A.
Michael Doghese	131 Appleton Street, Ellis N.A.
S. Lizio	Two Dartmouth Street, Boston 02116
Tony Cassendino	CBT, 306 Dartmouth Street, Boston
Susan Straight	Eight St. Neighborhood, 31 Milford St, Boston
Clark Frazier	SECOT
Bill Kuttner	199 Mass. Ave. #210, Boston 02115
	28 Bradford Street, Boston 02148
John M. Pizikiewicz	28 Bradford Street, Boston 02148
Tunney Lee	135 Langley Road, Newton 02159
Stephen Walsh	WNEV TV
S. James	WNEV TV
Philip Caruso	City of Boston, Traffic & Parking Department
Peter Chin	237 Shawmut Avenue, Boston
Lou Niickinello	Deputy Secretary, EOTC
Denise Fazio	Deputy Secretary, EOTC
Ken Kruckemeyer	Mass DPW
Hilary Bacon	EOTC
Avis Gaits	EOTC
Pat Minaulto	Massport
Jack Corrigan	EOTC
Pamela Mullender	Massport
Ann Wong	80 Pilgrim Road, Boston
Michael Taylor	487 E. Brandon St., South Boston, Coucil Candidate, District 2
Paul Wright	34 Dartmouth Street, 02116/Chris Hayes
Joe Mirisola	613 East 6th Street, South Boston 02127
Mary Nee	789 E. Broadway, South Boston 02127
Janet Foscaldo	487 E. Broadway, South Boston 02127
Ken Sinkiewicz	487 E. Broadway, South Boston 02127
Michael Shea	EOTC
Jennifer Watson	EOTC
Fred Langone	City Hall
Sal DiMasi	State House
W. Dean	Tr________ Department
Marianne Abrams	CBT Architects, 306 Dartmouth Street, Boston
Betsy Johnson	11-1/2 Greenwich Court, LWV of Boston

ATTENDANCE
Informational Meeting
Chinatown/South End

NAME	ADDRESS and/or ORGANIZATION
Wellego Y. Tou	12 Brock Street #2, Brighton
P. Corcoran	92 Appleton Street, Boston
S. Campbell	46 Dartmouth Street, Boston
K. Campbell	46 Dartmouth Street, Boston
Robin Young	WNEV TV
Donna Paul	S.E. News
Andrew Dreyfus	59 Magazine Street, Cambridge
Thor Jourgensen	S.E. News
Fred Salvucci	
Dan Kauff	WBZ TV
Matt Coogan	EOTC
Gordon Brigham	HFMW
Gordon Slaney	HFMW
Lenny Barbieri	HFMW
Adel Foz	HFMW
Lydia Mercado	HFMW
Mary Konsoulis	HFMW
Mary Angela Satta	
Enzo Satta	HFMW
Carole Schlessinger	HFMW
Skip Smallridge	HFMW
Marilyn Newman	EOTC

H-F-M-W 60 First Avenue, Waltham, MA 02254 (617) 890-84
Howard Needles Tammen & Bergendoff•Fay, Spofford & Thorndike, Inc.•CE Maguire, Inc.•Wallace, Floyd, Associates Ir

MINUTES OF THE EAST BOSTON INFORMATION MEETING

THIRD HARBOR TUNNEL/CENTRAL ARTERY DEPRESSION EIS/EIR

1 AUGUST 1983

Approximately 125 people attended the East Boston Information meeting held at the Harborside Community School Auditorium, 312 Border Street, East Boston.

The meeting was opened at 7:25 p.m. by Gordon Brigham, Deputy Project Manager for Planning, HFMW. Mr. Brigham explained that the meeting was part of a series of public information meetings whose purpose is to present the material in the original DEIS and the Supplement to the DEIS, and to offer an opportunity for questions on this material. Mr. Brigham announced the Public Hearings on August 8 and 9, and invited anyone who wished to testify to call the Department of Public Works to arrange a time. Mr. Brigham then introduced Fred Salvucci, Executive Secretary of Transportation and Construction.

Secretary Salvucci gave an overview of the history of the project. In 1968, Mr. Salvucci opposed the Cross Harbor Tunnel proposed for the railroad alignment. In 1972, Governor Sargent proposed a tunnel to the airport. This was opposed by Massport, which did not want to give up any land for the tunnel. In 1975, Mr. Salvucci became Secretary of Transportation and Construction in the Dukakis administration. The focus was shifted to widening and depressing the Central Artery rather than building another tunnel. The money for the tunnel was re-programmed to mass transit in 1978. In 1979, the King administration went back to studying the Cross Harbor Tunnel with possible alignments through the railroad right of way and Jeffries Cove. In January of 1983, Michael Dukakis was again Governor, and Mr. Salvucci was again Secretary of Transportation. The incoming administration commenced study of both projects. The previous alignments for the tunnel had been opposed by East Boston residents the railroad alignment was dropped by the Dukakis Administration because it was too damaging to the East Boston neighborhood. It was hoped that this would encourage people to examine the merits of the tunnel on less controversial alignments. But the Jeffries Cove alignment was still objectionable, and a new alignment to Bird Island Flats was proposed. Work has been done on these alternatives for the past six months. The issues of a Third Harbor Tunnel/depressed Central Artery have come up because of traffic. Money has been spent on transit, and transit will continue to receive investment. But traffic has continued to worsen. The EIS must be finalized by September 30 in order to get Federal support for the project. To summarize the consultants' findings to date: (1) widening and depressing the Central Artery is feasible and will relieve traffic pressures; (2) tunnel alignments to the airport are feasible. Secretary Salvucci asked for two kinds of public input -- first, whether people approve of the project, and second, what are other ways to improve the proposals.

Mr. Brigham then introduced Lenny Barbieri, Deputy Project Manager for Engineering, HFMW.

Mr. Barbieri gave an overview of the alternatives. These alternatives consist of the No Build, which includes re-decking the Artery (at a cost of $30 million to $35 million and three years of construction. This is the minimum alternative); depressing and widening the artery only; building a tunnel only; and the Full Build alternatives, which include both Tunnel and Artery depression. A series of slides summarizing regional impacts were shown. These included hours of Level of Service E or F, annual vehicle miles traveled, queue lengths, accident rates, air quality, noise form traffic, business relocations and the economic benefits of construction. Mr. Barbieri presented the 5A Modification alignment. This alignment goes further east in South Boston, and over to Bird Island Flats. The 5A alignment originally took part of the East Boston Memorial Stadium to make the connections to Route 1A. In 5A Modified, the connections are now to the north of the access road and the Stadium land is not taken. The connection on the airport side now frees up land near the Stadium, which could be added to the park. The vent building is placed further south, away from the community. Work on this alignment is continuing.

Mr. Bill Mandeville, of Eastern Airlines, observed that the Reservation Center is taken by this alignment, and asked if the western hangar would also be taken. Mr. Barbieri answered that that would depend on the economics of underpinning the building. Mr. Mandeville stated that even with underpinning, a relocation could be required because of sensitive equipment which would be disrupted by the underpinning. He also asked what happens to the fuel farm. Mr. Barbieri answered that it may be taken, as the plans are still being developed.

Mr. Brigham then described the map of Boston after the completion of 5A Modified. The Central Artery depression introduces development parcels, and studies need to be done to decide what structures can be physically supported and what land uses will be compatible. Several issues raised by the project include the compatibility of the project with land use plans in the North Station area, the re-introduction of the Bulfinch Triangle, the bridge crossings and their effects on MDC plans for the Charles River, the ramps to Leverett Circle, etc. Other effects include new development parcels near Haymarket and North End, improved pedestrian safety, the Walk to the Sea, and improved access to downtown retail. Issues relating to the northbound portion of the split alignment include protection of the historic Fort Point Channel. Alternative 5A modified also deals with providing truck access to the industrial areas of South Boston without using local streets. Mr. Brigham then described the effects of 5A Modified on East Boston and South Boston. The toll plaza will be located on Commonwealth Flats, much further away from residential areas. The vent stack will also be further way from neighborhoods. There will be takings of several businesses on Airport property. There will be no conflicts with bus movements, and no change in access to Route C1. Alternative 5A involved taking part of East Boston Memorial Stadium.

Alternative 5A Modified avoids that, and in the process creates a parcel which could be added to the park. Because of ramp construction, there will be construction easements in this area.

Mr. Brigham then recognized several distinguished guests and asked for their statements.

Representative Gus Serra spoke of not supporting past proposals for a Third Harbor Crossing because these alternatives were destructive of homes and areas of East Boston. If there is a realistic alternative which does not take land from East Boston, and if it will take account of the concerns of people on both sides of the water, then it should be examined in a favorable light. Representative Serra said he is comfortable with Governor Dukakis' campaign statements that he will work with the community to see that all concerns are met.

Councilor Fred Langone said he is trying to see if this is a good proposal for the people of East Boston. Mr. Langone has been working on the Chelsea Street Bridge construction and has watched traffic which can't get through the existing tunnel. Councilor Langone: Will the project help traffic now having trouble getting through? The tunnel takes traffic and drops it at Bird Island Flats. This will be more of a problem in 1990. We're bringing more traffic to East Boston. Where will it go after it reaches the stadium? What will happen to peak hour traffic on C1? Will the people of Maverick Street, Porter Street, etc. suffer from more traffic? Will access roads have to be widened? The map doesn't go beyond the access roads -- what happens at Bell Circle? Direct the project not only to getting traffic across the Harbor, but to where the traffic will go once it is in East Boston. You're payed to get the traffic out of East Boston. Councilor Langone said he will remain opposed to the project until those questions are answered. He also suggested a token system for tolls, and free tolls for East Boston residents. Water-based transportation should also be used. Councilor Langone said that when (Governor) Dukakis promised no Third Harbor Crossing, he didn't condition that on changing the route.

Mr. Brigham responded that questions on traffic would be answered later in the meeting. He recognised Fred Battaglia, representing Senator LoPresti.

Mr. Battaglia asked if there will be some takings in East Boston, and where will they be? (Mr. Brigham: All of the takings are on airport land. There are five takings in all. Other properties will be underpinned as required.) Will the stadium be taken? (Mr. Brigham: No, it could be added to.) Will there be inconvenience to East Boston? (Mr. Barbieri: Construction would be cut and cover, done in three sections. Each section would take one to one and a half years, so there would be three to four years of construction.)

Other audience members asked if that would mean trucks, etc. in East Boston. (Mr. Barbieri: Construction vehicles would use a construction staging area in Bird Island Flats, near the location of the vent building.)

A question from the audience: If the tunnel is built, is there any way to force commercial traffic onto that tunnel? (Mr. Brigham: As Federal money would be used, the tunnel would be a free road open to all. Also, hazardous cargo would have to use the bridge system.)

Mr. Battaglia: The Senator has studied the plan and is in favor of it. Various comments from the audience: The Senator is not interested in East Boston...

A question from the audience: What about noise from construction, can the administration make contractors use quiet equipment? (Mr. Brigham: Yes, all appropriate measures to minimize construction noise will be made. Any workable techniques will be used)

Mr. Bob Capucci, candidate for City Council: If a Third Harbor Tunnel is built, traffic coming to East Boston should be made to leave the same way, i.e., through the Tunnel. Traffic would only be able to travel to and from Logan Airport.

John Vitigliano, Commissioner of Traffic and Parking for Boston:

Commissioner Vitigliano is in support of the project for four reasons:

1. The primary goal is to get cars out of East Boston. The airport alignment would do this.
2. East Boston residents use the existing tunnel. A third tunnel will benefit these people.
3. Significant air pollution problems arise from the vent building in Tower Street area. The third tunnel with vents at the airport would reduce pollution in East Boston, diverting it to the airport.
4. If this scheme is passed, future politicians can't push for another tunnel on an alignment that would be more damaging to East Boston.

A question from the audience: How many jobs would be created by building a Third Harbor Tunnel, and how many would go to East Boston residents? Unemployment in East Boston is 19%, and East Boston residents can't work at Logan. Also, East Boston residents should use the tunnel for free. (Mr. Brigham: The two Full Build alternatives would create 55,000 to 65,000 person-years of employment. Because of the city's policy of preferential hiring, some 10% to 20% of the jobs would go to Boston residents. The secondary impacts of construction would also create jobs. Massport hiring practises are beyond the scope of an EIS, but the concern will now be part of the public record, for agencies to respond to.

Mr. Jack Scalcione of the Coalition Against a Third Tunnel (CATT): The tunnel is only a band-aid. Transportation management is needed, even if the tunnel goes through, improvements to mass transit are still needed. We need to study transit expansion to Logan. As for jobs, the alternatives proposed by CATT will put more people to work than a tunnel will.

The sunken tube method means much of the labor-intensive work is done outside of Boston. The project will need high-level technicians, who will not be local. There will be some local jobs, but not steady employment. There isn't enough money available to do both the tunnel and transit improvements. The tunnel will take away incentives to build transit. We request that the state study and implement alternative methods before building a third tunnel.

Question from the audience: When will the trucks be on our roads? (Mr. Barbieri: Construction in residential areas will stop at 7:00 p.m. and won't happen on weekends. Starting time will be 7:00 or 8:00 a.m.)

Mr. Sal Venezia, resident of East Boston: Mr. Venezia has fought the airport and the tunnel proposal for the last 15 years because of what it would do to East Boston. But this study is the best thing that happened to East Boston because it will help rather than hurt East Boston. If traffic is routed to Bird Island Flats, it will reduce traffic on East Boston streets.

Question from the audience: Has there been a study of wind patterns? Would the fumes from the vent buildings reach East Boston? (Mr. Brigham: This is now being studied. Moving the vent building further south and away from the community should lessen the problem of fumes drifting to East Boston)

Question form the audience: When can community members critique the new alignment? (Mr. Brigham: Some of the data is available now, more data will be available before the end of the comment period. The presentation couldn't go into that much detail tonight, but questions can be answered in greater detail by speaking with individuals on the consultant team.)

Mr. Brigham then announced the Public Hearings on August 8 and 9, and specified that those who wished to make statements should call the Department to make arrangements. Written comments could also be submitted.

Mr. Langone asked if the Department would set up a specific time to let East Boston residents testify. (Mr. Brigham: That can be arranged by calling the Department.) Mr. Langone: Its up to the consultants to arrange it. (Mr. Brigham: The sign up sheets at the door could be used to sign up for specific times to testify.)

EAST BOSTON

ATTENDANCE LIST

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Arthur Brooke	P.O. Box 442, Boston 02130
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Gloria Caserta	43 Orleans Street, East Boston
Mary Limongiello	9 Murray Court, East Boston
Rose Catena	275 Sumner Street, East Boston
Jim Killilea	Office of Rep. Emanuel Serra
Donald B. Hitchcock	Reading
George H. Sioras	19 Charles Street, Allston
Michael Shea	EOTC
Philip Caruso	Boston Traffice & Parking Dept.
Marjorie Backman	18 Sansuit Street, Dorchester (BU)
Gary Heber	HFMW
Meng Chng	BBN
Mr. & Mrs. Bill Kelleher	
Jo Stevenson	Avis Rent-a-Car, Logan Airport
Bob Shine	" " " " " "
Lucy Ferullo	23 Haynes Street, East Boston, JPHNA
R. Mardri	Massport
Bob Eddy	13 Haynes Street, East Boston
Grace Succaro	196 Maverick Street, East Boston
Doreen Zankowski	BU/Planner
Jeanne Ray	BU/Student
Dennis M. Campbell	30 Hancock Street, Salem, BU/Student
Mark McCormack	BU/Student
John J. Thomas	24 Horace Street, East Boston
William Mandeville	Eastern Airlines, Miami, FL
Terri Minsky	Boston Globe
Alice Christopher	972 Bennington Street, East Boston
Diane Modica	78 Barnes Avenue, East Boston
S.T. Siegel	Diversified Engineering Services, Boston
John Avitjin	Boston T&P
Phil Giffee	112 Trenton
Mark Battite	30 Berkeley Street, Arlington
Fran Riley	193 Trenton Street, East Boston
Jack Scalcione	36 Frankfort Street, East Boston
Gina Scalcione	36 Frankfort Street, East Boston
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MaryAnn Hart	1055 So. Artery, Quincy, BU
Steve Bondini	East Boston, National Car Rental
Joan Elkins	Back Bay, BU
Fred Battaglia	Boston, Senator LoPresti's Office
James E. White	43 W. Eagle, Street, East Boston
E.F. Derbentli	151 Leyden Street, East Boston
Bob D'Amico	300 Maverick Street, East Boston
Carrie Revander	10 Hancock Street, Boston
Lindoro C. Tescione	127 Barnes Avenue, O.H.I.O.

EAST BOSTON

ATTENDANCE LIST

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M. Diaz	175 Freeman Street, BU
Mariellen Ruiz	185 Freeman Street, BU
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C. Heepke	121 Browne Street, BU
R.J. Penta	Winthrop
N. Faramelli	99 High Street, Boston, Massport
Theresa Cipriano	17 Lamson Street, East Boston
Fred Stefano	75 St. Archer Road, East Boston
L. Vella	91 Trenton Street, East Boston
Josepha Vella	91 Trenton Street, East Boston
Robin Young	WNEV-TV
David B. Brenner	East Boston Fair Share
Jean Riesman	East Boston Community News
Josephine Gioisa	
Anthony Paglina	East Boston
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Joe Aiello & Mary Mitchell	191 Trenton Street, East Boston, 567-9025
Sal Venezia	115 Colesredge Street, EB, 567-2825
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Sam (Sonny) DePaulo	121 Cottage Street, East Boston, 567-0193
John & Noreen Cataldo	45 Gladstone Street, East Boston
Laura Brown	112 Trenton Street, East Boston
Mary Ellen Welch	470 Summer Street
Fred Langone	
Anna DeFronzo	
Lou Nickinello	
Denise Falco	
Gordon Brigham	
Fred Salvucci	
Len Barbieri	
Linda Ross	
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MINUTES OF THE SOUTH BOSTON INFORMATION MEETING

THIRD HARBOR TUNNEL/CENTRAL ARTERY DEPRESSION EIS/EIR

1 AUGUST 1983

Approximately 80 people attended the South Boston Information Meeting for the Third Harbor Tunnel/Central Artery Depression DEIS/DEIR held at the South Boston Branch Library, 646 East Broadway, South Boston.

Eamon Connally (EOTC) opened the meeting at 7:10 p.m. by introducing MDPW Commissioner Robert T. Tierney. Commissioner Tierney explained the study process, and that the neighborhood information meetings are a preliminary for the public hearings. He stated that the findings of the DEIS and SDEIS were being presented in order to explain the alternatives being studied, and the impacts of these alternatives. Com. Tierney announced that the formal Public Hearings would be held on August 8 and 9, and that time slots for presentations could be arranged by contacting Jack Corrigan at EOTC. Comments presented at the hearings can be either verbal or written. He explained that comments made during the information meeting would not become part of the official record. Com. Tierney also explained that the project schedule is based on a September 30 funding deadline.

Com. Tierney introduced Matthew Coogan, Undersecretary of Transportation and Construction for Project Development. Mr. Coogan explained that the current alternatives resulted from meetings with the various communities in the project area. Slides were shown to explain the six alternatives currently under study. It was explained that the No-Build Alternative requires redecking the existing Central Artery, and is therefore not actually a No-Build. The Build Alternatives were divided into three families, Artery Only (6), Tunnel Only (3 & 5), and Full Build (3A, 5A & 5A Modified). It was further explained that Alternative 5A Modified was developed to accommodate the truck traffic through South Boston, therefore serving as a Seaport Access Road. It has one interchange for the Fan Pier and one interchange for BMIP, EDIC, Commonwealth Flats, White Fuel, and the rest of the northern industrial part of South Boston.

Mr. Coogan introduced Gordon Slaney, Project Manager for the Joint Venture. Mr. Slaney summarized the regional impacts of the project, using a series of slides. He compared the six alternatives on the basis of Hours of Level of Service E or F, Vehicle Hours Traveled, Change of Central Artery Queues, Regional and Local Accidents, Local Air Quality Impacts, Traffic Noise, Displacements/Relocations, and Economic Benefits, using the No-Build Alternative as the Base Case and 2010 as the year for comparison. Mr. Slaney gave a very brief explanation of construction, and stated that the Full Build Alternatives would involve five $150 million contracts over a nine to twelve year period. A Third Harbor Tunnel would require three to four construction years.

Mr. Slaney introduced Adel Foz, Deputy Project Manager for Planning and Urban Design for the Joint Venture. Mr. Foz discussed land use, urban design, historical, and community impacts of the project, going through the project area by neighborhood and explaining the trade-offs associated with each area. The impacts on South Boston and East Boston were explained using Alternative 5A Modified. Mr. Foz briefly explained that the widening concept had been dropped because it involved impacting 27 buildings, several of which were historic and/or residential.

Mr. Foz then turned the meeting back over to Com. Tierney for a question and answer period. Com. Tierney stated that this was only one of many neighborhood meetings which will take place if the project is approved. The following comments were made by community residents (answers given are in parentheses):

1. How can someone testify at the Public Hearings if more detailed explanations of the alternatives are not made? (Mr. Foz explained the details for South Boston of each of the alternatives.)

2. Why is relocated Dorchester Avenue in some of the alternatives, but not in all of them? (Mr. Coogan: This method was used to determine exactly what function Dorchester Avenue would serve. It appears to take traffic off of A and D Streets.)

3. Will relocating Dorchester Avenue increase traffic around Broadway Station and the surrounding area? (Mr. Coogan: It will increase traffic through the Broadway Station area, but will decrease traffic in northern South Boston.)

4. How can these plans help South Boston if the capacity of the S.E. Expressway is not also expanded? This project is going to result in a lot more traffic on Broadway. (Mr. Coogan: Traffic on the S.E. Expressway is related to backups on the Central Artery.)

5. Has anyone looked into increased traffic on the S.E. Expressway? Will the reconstruction of the S.E. Expressway increase its capacity? (Mr. Coogan: The S.E. Expressway will have more traffic in the future, but it will be traveling more smoothly as a result of the reconstruction.)

6. If the West Fourth Street and Broadway Bridges are closed during construction, how will South Boston residents get to downtown Boston? (Mr. Coogan: Both bridges are scheduled for replacement already. The replacement will be coordinated with construction of this project. Mr. Foz: The West Fourth Street Bridge will be rebuilt first so that it will be able to carry MBTA buses during the Broadway Bridge closing. The Summer Street Bridge will be closed one half at a time. The Congress Street Bridge will also be closed one half at a time. The New Northern Avenue Bridge will be left open at all times.)

7. Has a traffic analysis which looks at bridge closings been done for the construction period? (Mr. Foz: Yes; it is included in the DEIS and the Supplemental Engineering Report.)

8. Why have so many concessions been made to East Boston? What about South Boston? This project won't help the truck traffic and South Boston has to put up with three vent buildings and bridge closings. (Mr. Coogan: Alternative 5A Modified will serve as a Seaport Access System, taking trucks off of South Boston residential streets.) No it won't. South Boston asked for specific solutions and did not get them. The residents want relief now, not in twelve years. (Mr. Coogan: Alternative 5A Modified is a Seaport Access System and the tunnel will require only a three to four year construction period.) We want improvements to the truck route.

9. Does this Seaport Access System include Castle Island? (Mr. Coogan: Yes.) Why isn't Castle Island mentioned? Why weren't the residents of that area contacted? What about a bridge from Castle Island to the Army Base, across the Reserve Channel? (Mr. Coogan: Castle Island is there; we have to deal with it as a given. It is owned by Massport and unhappy citizens should speak to that organization.)

10. How can we testify if you won't tell us which alternative is the preferred alternative? (Com. Tierney: We aren't supposed to be taking sides now, i.e., choosing an alternative. That's why we're going to the public - so the people can decide. Governor Dukakis will decide based on your comments.

11. Is the Tobin Bridge going to be widened - that's where the bottleneck is? (Com. Tierney: Modifications are being made to the Tobin Bridge as part of the North Area Project.)

12. Has anyone talked with EDIC about changing their roads? (Mr. Coogan: Yes, they have expressed a desire to reconfigure their access road and we are cooperating with them on this project.)

13. How can you submit a plan to the Governor if you don't have a plan? (Com. Tierney: The Governor examines all six alternatives, and chooses the preferred alternative. After that, there will be two to three years of design, during which community concerns will be addressed.) We're wasting time talking about six alternatives when only one will be built. We want more time to talk bout that one. We never knew about bridge closings or traffic on Broadway and Dorchester Avenue.

14. Will there be a Public Hearing on the Final EIS? (Mr. Coogan: There will be a 30 day comment period for the FEIR.)

15. What about the Summer Street Bridge - it's not working now. (Com. Tierney: Repairs have been scheduled for the Summer Street Bridge across the Reserve Channel.)

16. How do South Boston residents get into the new tunnel? (Mr. Coogan explained the route.)

17. South Boston residents are skeptical. The first expressway was supposed to solve traffic in South Boston.

18. The benefits for South Boston are limited and the costs great. The project benefits South Boston developers and developers of the air rights parcels, not South Boston residents.

19. The study doesn't address the origin of the issue, which was the Seaport Access Study. What about hazardous cargos? (Mr. Coogan: Making the tunnel available to trucks carrying hazardous cargos is one of the design critieria.)

20. Has the Red Line tunnel been thoroughly examined? (Mr. Coogan: Yes; a detailed structural analysis has been done with the cooperation of the MBTA.)

21. Will there be more information on Alternative 5A Modified if it is chosen as the preferred alternative in the Final EIS? (Mr. Coogan: Yes; it will be analyzed at the same level of detail as the original alternatives.)

22. Have you considered an MBTA tunnel to the airport? (Mr. Coogan: BTPR looked at a van pool and bus tunnel and rejected the idea because the data showed that only a limited number of people use public transit to get to the airport. Buses could use the new tunnel. The current tunnels have roughly 50/50 airport/other traffic.)

Com. Tierney closed the meeting by reminding everyone to come to the Public Hearings.

SOUTH BOSTON

ATTENDANCE LIST

NAME	ADDRESS AND/OR ORGANIZATION
L.J. Walsh	1588 Columbia Road, South Boston
Janet M. Larkin	825 E. 2nd Street, South Boston
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Mario Aisquro	Boston
Jack Enos	Geotechnical Engineers Inc.
Martin Nee	Rep. Michael Flaherty's Office
James Yost	577 Broadway, South Boston
Nancy Yotts	338 E. Street, South Boston
Paul L. Laud	509 E. Broadway, South Boston
Anthony W. Kane	125 W. 4th Street, South Boston
Hilary Bacon	EOTC
Jack Corrigan	EOTC
E.M. King	M.T.A.
C. Anderson	
J. Byrne	South Boston
Janet Foscaldo	458 E. 6th Street, South Boston
Tom Butler	So. Boston Citizens Association
Bill Doherty	Councilor Flynn's Office
Harry Hayes	156 W. Canton Street
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Susan Houston	CC & F/ 60 State Street, Boston
Thomas Maistros Jr.	HFMW
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Ruth P. Fields	211 A Street, Ft. Point Arts Community
George Vasquez	348 Congress, Ft. Point Arts Community
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Bill Oliver	MDPW
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Jerry Gongine	11 Mitchell Street, South Boston
Barbara Connolly	
Charles Kalauskas	BSC Engineering, 647 Summer Street
A.W. Mahoney	91 Old Harbor Street, South Boston
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Jo Hanson	624 E. 3rd Street, South Boston

SOUTH BOSTON

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Adel Foz	HFMW
Gordon Slaney	HFMW
Commissioner Robt. Tierney	MDPW
Matthew Coogan	EOTC
John Yaney	HFMW
Coleman F. Greene	735 East Third Street
James Higgins	873 Broadway
Alice Boelter	Massport
Dorothy Baxter	885 E. Fourth Street
Lois E. Skylar	789 E. Broadway
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Marilyn Newman	MDPW
Donna Rosasso	80 H Street, South Boston/Massport
Dan Yotts	338 E Street, South Boston
Michael Taylor	68 G. Street, South Boston
Julia Michalski	131 W. Third Street, South Boston
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Jennifer Watson	EOTC
Art Hontrit	Pres., South Boston Residents Group 169 K Street, South Boston
June Byrne	8 Shipton Terrace, South Boston
Joanne Tuck	271 Mt. Vernon Street, W. Newton
David Zannata	28 Albano Street, Roslindale
Alice N. Ballon	496 E. Broadway, South Boston
Ray Flynn	
Frank Bagnali	16 Mitchell Street
Theresa Mueller Byrne	99 W. Broadway, South Boston
W. Lacey	Boston
Brian O'Donnell	211 M Street, South Boston
Chris Hayes	156 W. Canton Street
John Curn	South Boston

MINUTES OF THE NORTH END INFORMATION MEETING

THIRD HARBOR TUNNEL/CENTRAL ARTERY DEPRESSION EIS/EIR

2 AUGUST 1983

Approximately 200 people attended the North End Information Meeting held at the Christopher Columbus High School Gymnasium, 44 Prince Street, Boston.

Mr. Lou Nickinello, Undersecretary of Transportation and Construction, opened the meeting at 7:15 p.m. Mr Nickinello introduced Matthew Coogan, Undersecretary of Transportation and Construction for Project Development. Mr. Coogan announced that there will be Public Hearings held on August 8 and 9. People who wish to make statements could do so at the Public Hearings, or written statements could be submitted to the Department of Public Works by August 22; these questions and comments must be responded to. Mr. Coogan explained that the purpose of the meeting this evening was to informally summarize the DEIS and the Supplement to the DEIS. Questions would be answered following the presentation. Mr. Coogan explained the environmental review process. After August 22, a decision will be made as to the preferred alternative. The final EIS would then be completed by September 30, and would be reviewed and commented on. Citizen input would continue throughout this process. If the Governor proceeds with the project, and the Federal Highway Administration approves, the next phase will be the design phase, which would last approximately three years. There will be public meetings throughout this phase, culminating in a Design Hearing.

Mr. Coogan then gave a brief summary of the Alternatives, using slides to illustrate the family of options: the No-Build, Artery only, Tunnel only and Artery plus Tunnel. Mr. Coogan stated that there really was no No-Build option because the bridge decks of the Central Artery must be jackhammered out and replaced with a new concrete surface. This process will take approximately three years, and will cause one lane of the Artery to be closed. This would increase traffic congestion. Depressing the Artery would not cause the loss of capacity, as no lanes would need to be taken out of use. Another option, that of widening the Artery, was examined, but the State judged that the impacts would be too severe. Mr. Coogan then introduced Gordon Slaney, Deputy Project Manager, HFMW.

Mr. Slaney reviewed the impacts described in the DEIS, using slides. Mr. Slaney highlighted the reduction in traffic afforded by the Full Build alternatives. Accident reduction, air quality improvements, and reduced noise from traffic would also result from the Full Build alternatives. Business dislocations, economic benefits from construction (jobs and money spent) were also discussed. Mr. Slaney then introduced Gordon Brigham, Deputy Project Manager for Planning, HFMW.

Mr. Brigham summarized the picture of what Boston would look like after the construction of the 5A Modified alternative, using a map of Boston. Mr. Brigham pointed out the development parcels which would be created by the depression of the Artery -- about 20 acres of land, stretching about one mile from Dewey Square to Causeway Street. The major impacts and unresolved issues were summarized as follows:

1. The new bridges at a lower level in the North Station area. raise concerns about shadow impacts. Also, issues of compatibility with Boston Redevelopment Authority (BRA) plans in the North Station area would have to be worked out so that the new ramps would not cause conflicts,
2. The opportunity to re-create the Bulfinch Triangle,
3. The re-establishment of the Walk to the Sea and the possibility of "knitting the city back together", and
4. Northbound traffic would be in an alignment along the edge of the Fort Point Channel, and that alignment must respect the historic importance of the Channel.

In South Boston, the alignment goes underground, the tunnel leaves South Boston through the Boston Marine Industrial Park, crosses the Harbor and comes up to the existing Airport road system in the Bird Island Flats. Alternative 5A Modified is an improvement over 5A, as the roadway, toll plaza and vent buildings are located further away from residential communities, and thus have less impacts. Of specific concern to the North End are the new parcels on top of the depressed Artery. Based on physical constraints, and also on what would fit in with the nearby buildings, eight stories would be the maximum height. Access between the North End and downtown will be greatly enhanced by the re-establishment of the surface roadway system. The uses for the new parcels could be residential, commercial, etc., but the process for deciding on appropriate uses will begin during the design stage, and will be an on-going process involving the community, the state and the city.

Mr. Brigham then introduced Lenny Barbieri, Deputy Project Manager for Engineering, HFMW, to discuss construction techniques and staging.

Mr. Barbieri described how the project area is divided into several areas (North Area, Central Area, South Bay Area, South Boston and East Boston) and showed each of these on the map. He spoke of the cost of building the project in each of these areas. The South Bay, South Boston and East Boston areas would be built over the first three to four years. The area from Dewey Square to Causeway Street would take nine years. The area north of the Charles River would take three years. The southern areas will be finished before the central area is started. Mr. Barbieri then used slides to illustrate some of the construction techniques. These slides showed the existing structure of the Artery, the process of surface decking and slurry wall construction, excavation and pile removal, Central Artery tunnel construction and the structure of the new completed Central Artery. Slurry walls would be 100' down to till, and would allow both the elevated Artery and the surface artery to remain in use during construction. The area under the Artery from North Street to Causeway

Street is now used for parking. This will be disrupted after the first two years. There are two areas where temporary parking will be available: the Government Center Garage and BRA Parcel 7. Various sites for permanent parking will be available, such as opposite Dock Square garage. A construction road from Causeway Street to Dewey Square will be used to prevent construction equipment and trucks from going through North End streets. There will be vibration impacts in three or four areas of the North End, as utilities in these areas will have to be pile supported. Some soils, such as clay, will have to be trucked out of the area. Dust will be a problem until the construction goes underground. Mr Barbieri then turned the floor over to Mr. Nickinello to take questions from the audience.

Mr. Nickinello recognized Councilor Langone.

Mr. Langone stated that: Having been through this process 32 years ago, his concern is with the impacts of the project. Before, there was pile driving, heavy equipment, disruption of traffic, noise, and dust, all detrimental to the quality of life during the five years of construction. In 1951, there was a Master Plan for highways which would divert traffic from the Central Artery. These were never built. The project now means 10 to 15 years of construction: roads blocked, traffic on local streets. The money from Washington for this project could be used to help the North End. The traffic survey says there are only 375 spaces under the Artery, but they fail to include 700 spaces on Haverill St and another 300 spaces elsewhere. These will be lost with the Artery project. People who want to come to the North End won't be able to park at Government Center or Quincy Market garages, as these are usually full now. There are already problems with circulation through the North End. Where will the traffic from the Boston Gardens go on nights when there are games? They're going to come into the North End and park on sidewalks, block fire trucks, etc. There will be disasters on Commercial Street, Atlantic Avenue, etc. Property owners are going to lose their tenants because no one is going to want to live here. The pile drivers would be going when you sat down to dinner and when you wake up in the morning. They say this will benefit the North End in 15 years, but people who have moved here to enjoy a quiet neighborhood are going to want to move out. We the politicians must be responsive to you. Do you want this for 10 to 15 years? Businesses lost 30% to 40% of their business when there was a tagging program. Can business withstand what the project will do now? This money isn't going to housing, (President) Reagan won't give money for that, only for these things that we don't want. The decision is yours, if you want this project. But you want to be safe, you want the answers now, not six months down the road. If the people of the North End don't get their answers before August 8 and 9, we'll hold a plebescite in the North End.

Mr. Nickinello then recognised other members of the audience who had questions. (Anwers to their questions are in parenthesis.)

Mr. Al Tecci, a resident of the North End: The elevated structure has kept business people from taking over the North End as they did in the West End. People won't be able to walk across Cross Street as two lanes

will be blocked, and there will be 1,000 trucks per week. Mr. Tecci showed a map of the North End, with a section near the Artery marked as zoned for business. They're not going to take any houses, but you'll be so inconvenienced that you will move out, and then this area will become like the West End. (Mr. Coogan: Pedestrian access will be maintained at Cross Street, and all major pedestrian accessways will be maintained under the Artery. Also, all surface streets will remain in operation. Cross Street will not be affected during construction. When the new Artery is opened, the on-ramp will be taken down, but this will be when traffic is already underground. Local streets will remain operational through the construction process until the new Artery is in place. Two lanes under the Artery, North Street to Dewey Square, will be a private road for dump trucks so they won't use local streets.) Mr. Tecci: The construction will be 20' away from the Artery, and how can someone walk near a tunnel 100' deep? (Mr Barbieri: There will be a barrier.)

Mr. Nelson Visconti, North End resident: There should be an overpass where the Sumner Tunnel comes into the North End. It's a safety hazard. (Mr. Nickenello: Your right in being concerned. We're required to have public input into the process.)

Mr. George DeMint, of the Mass. Rehab Hospital: Where are the access roads in relation to the Mass Rehab Hospital? (Mr. Barbieri: The road goes into the tunnel near the hospital.)

Mr. Vitigliano, Commissioner of Traffic and Parking: Councilor Langone spoke of a mistake the state made 30 years ago. Now the North End is faced with two choices: to depress the Artery or to rehab the existing Artery. There are two major problems with either choice: parking and traffic flow. After looking at the implications of both choices, there will be fewer negative effects with the depression than with the rehabilitation. All of the parking is eliminated during the construction of both, but the depressed Artery will minimize traffic through the North End. Rehabilitation of the Artery will disrupt traffic flow on the elevated Artery as well as on the Surface Artery. With the depression, only 50% of traffic under the artery is disrupted, and the elevated Artery is not disrupted at all. The depression of the Artery gives a better chance for protecting the North End from through traffic. Long-term benefits of the depressed Artery include possible construction of a multi-story garage on Hanover Street for use by residents and businesses. Pollution would also lessen as traffic is diverted from the Sumner/Callahan Tunnels. The depressed Artery is in the best interest of the North End.

Mr. Peter Patrini: How much say would the neighborhood have about what will be built over the depressed Artery? (Mr. Nickenello: Specific concerns of each person will be submitted as part of the EIS process, and each concern will be dealt with. The community is guaranteed participation every step of the way.) Mr Patrini: What about the process in Charlestown? (Mr Brigham: The design phase took three years in Charlestown because the process took account of public concerns through meetings, newsletters, etc. Mr. Donald Jackson of Charlestown: We had seven years

of meetings. The final year was stormy. The local community helped bring the project back to life when the project was stopped by the Federal government.)

Mr. Joe Pacci, part-time resident and businessman in the North End: The EIS says there will be 5% loss in business. Our businesses depend on outsiders. We will lose 35% to 40% of our business. Also, how do you propose to get rid of the fumes from the depressed Artery? (Mr. Slaney: Vent buildings will be located in the vicinity of relocated Northern Avenue, the Sumner/Callahan tunnels and the new bridges across the Charles River. These would keep fresh air in the tunnel. Overall air quality in the corridor will improve as a result of lessened traffic congestion. Mr. Coogan: No one actually knows how much business will be lost. We collected data from the Downtown Crossing study, and found that business went up because people came to look at the construction. The 5% symbolizes something, its not specific.) Mr Pacci: Why is all parking taken just to re-surface the Artery? (Mr Coogan: Construction crews will take up space, and have to jack-hammer through. The spaces underneath must be taken for safety reasons.) Mr. Pacci: Where are construction employees going to park? (Mr. Coogan: We'll encourage transit, and there will be designated employee parking spaces. They will not park in the North End. The Federal Highway Administration does pay for replacement parking.

Mr. Antonio De Mambro: I have two problems with the plans. First, the answers about the future uses of the parcels are unsatsifactory. This area is important to the North End and we can't wait until after the design phase to know what happens. We need guarantees. Secondly, once the Artery is depressed it will be wonderful for everyone. But, during construction, only North End residents will pay the price. Can the state help businesses during construction to help alleviate impacts? (Mr. Coogan: We first have to narrow down the options, which will occur in three weeks. Then we can make a contract between the city, the state and community groups to decide how the decisions will be made on the future uses of these parcels. We'll set up a mechanism to allow for community input, and certain standards will be set. These standards will be part of the construction contracts, so if there is any damage, people will be recompensed.)

Mr. Bob Dellaruso, for Representative DeLacey: Representative Delacey has a list of questions to leave with the consultants. These will hopefully be answered at the Public Hearings.

Mr. Bob Capucci: If the Central Artery is depressed, the North End should be given parking, subsidized housing, open space, a gymnasium. The new land opened up makes these types of developments possible. This will be a thank you to the North End for putting up with the negative impacts. (Mr. Coogan: The concept is logical, but the money to do this isn't part of the project. We don't have Federal money for housing from this project, but we'll make a commitment to find other ways of providing these things. They're just not as connected as you'd hope.) Mr. Capucci: Lafayette Place had UDAG and other funds, and the developers were from other countries. If the Department of Transportation is funding $2.1 billion, we should see if there are matching funds.

Mr. Fred Salvucci, Executive Secretary of Transportation and Construction: Thank you for coming and asking questions. Come to the Public Hearing, get your questions on record. We're obligated to answer. There are several important questions that were raised tonight. Does community participation end when the EIS is filed? This is the begining of the process, not the end. There will be meetings and hearings during design. We are committed to working with you, and legally we must do so. The issue of pedestrian crossings -- we recognize the necessity of maintaining those. We are going to have major construction on the Artery, either above or below. If we depress it, we'll have something to show afterwards. Parking and business -- we recognize the dependence of business on parking. Either way, parking will be disrupted. Either way, we are obligated to maintain parking. Planning for air rights -- we're commited to the process of developing community groups to plan for that land. We need community participation if we get the project approved. Pile drivers -- construction is always noisy. But slurry wall construction techniques make a lot less noise than the pile driving the North End experienced before.

Mr. John Savino, President of the North End Business Council: The 5% business loss quoted in the DEIS Supplement is doubtful and arbitrary. You must be more honest, your facts must be precise. You have to ask us how we're going to suffer.

Mr. Roland Orlandi: I will pay for the tombstone when they bury the Artery. You've done a good job working out the details. If you get it done, you'll be owed our thanks.

The meeting was closed by Mr. Nickenello.

Questions from Representative Delacey submitted at North End Informational Meeting and to be submitted at Public Hearing for the Record.

1. How is all of the parking throughout the community going to be affected during and after construction?

2. How will property damage during construction, i.e., cracks in the foundation, existing wall and ceilings be handled?

3. Will the community have input after September 30th or is this the final date for all comments?

4. What is the width of the tunnel.

5. How will noise, dust and truck traffic effect the Community?

6. How many people will be affected on their way home?

7. Do the citizens of the North End Community have a choice as to what the land is going to be used for?

8. Would a third tunnel cut 20% of traffic off of the North End?

9. Is a tunnel or a similar project being undertaken by any other state and are they facing the same problems?

10. What will be the sanitary conditions for the community? (Previous problems with water table during construction of existing tunnel)

11. Will the people of the community have time after the September 30th deadline to review the plan?

12. How many buildings will be taken in the North End community to construct this project?

13. Will the residents of the North End have excess to their automobiles in commuting to and from the area?
    What will the parking situation be like?
    What will be the pedestrian situation?

14. Will there be train service to and from North and South Station for the North End Residents during the depression of the artery?

NORTH END

ATTENDANCE LIST

NAME	ADDRESS AND/OR ORGANIZATION
Teresa Palermo	20 Henchman Street, Boston
Josephine Piccadaci	29 Charter, Boston
Arthur Brooks	P.O. Box 442, Boston 02130
Catherine Pacella	185 Fulton Street, Boston
Rubina DeCensa	185 Fulton Street, Boston
Etta Pericotti	185 Fulton Street, Boston
Barbara Bobong	142 Commercial Street, Boston
Mary Carey	110 Commercial Street, Boston
Alice Marano	141 Salem Street, Boston
Gilda Bova	109 Salem Street, Boston
Lucy Ferullo	EOTC
Dom D'Ambrosio	51 Burnside Street, Medford
Michael R. DeFronzo	11 Sheafe Street, Boston
Bruce H. Beatt	142 Commercial Street, Boston
Ellen M. Brown	142 Commercial Street, Boston
James J. Sablone	7 Prince Street, Boston
Barbara R. Sablone	7 Prince Street, Boston
Carmelo Lento	19-1/2 Tilestone Street, Boston
Mark Kane	372 North Street, Boston
Delores Katz	59 Snow Hill Street, Boston
Loretta Daley	60 Prince Street, Boston
Ann Caggiano	78 Prince Street, Boston
Dora DeNapoli	161 Endicott Street, Boston
Mary Caruso	161 Endicott Street, Boston
Joseph A. Colarusso	29 Thacher Street, Boston
Pamela Mullender	440 Hanover Street, Boston, Massport
Joseph DiCenso	422 Hanover Street, Ward 3, Boston
M. Johnston	WNEV-TV
Mary Ann D'Amato	13 Noyes Place, Boston
Guarino Francesco	64 Prince Street, Boston
Robert F. Hannan	Boston City Council Staff
Liberatore Feltereco	2 Holden Court, Boston
Camille Calangelo	74 No. Margin Street, Boston
Angela Capucci Aquilino	One Snelling Place, Boston
Sue Rossi	3 Wesley Place, Boston
Calogera Lacinto	5 Quincy Court, Boston
Nellie Ponzo	8 Moon Street, Boston
Joe Mantone	15 Margaret Street, Boston
Franca Firicano	227 North Street, Boston
John Bruno	1 Mechanic Street, Boston
Josephine Buscimi	23 Clark Street, Boston
Grace Meniario	18 Wiget Street, Boston
Josephine Ippolito	1a Unity Street, Boston
Robert Belemly	78-1/2 Blackstone St., Prospect Mkt, Boston
Peter Cucchian	58 Endicott Street, Boston
Mark Forgentt	27 Cleveland Park, Boston

NORTH END

ATTENDANCE LIST

NAME	ADDRESS AND/OR ORGANIZATION
Helen Rossetti	142 Prince Street, Boston
Roland Orlandi	120 Commercial Street, Boston
Marie Parker	209 Salem Street, Boston
Lena Bravoco	16 Margaret Street, Boston
Mary Visconti	3 Baldwin Place, Boston
Anna Comperchio	19 Snowhill Street, Boston
Joe Urenech	2 Marlowe Street, Dorchester
Laura Zannini	2A Baldwin Place, Boston
Teresa Comeau	14 Hill Street, Boston
Peter Petrigno	3 Goodridge Court, North End, Boston
Michelino Mantia	414 Commerce Street, North End, Boston
Margaret Keyes	Newton, MA
Marguerite Pezza	11 Bartlett Place, North End, Boston
Joe Mirisola	Joe Mirisola for City Council
Katherine E. Murphy	Joe Mirisola for City Council
Michael Shea	EOTC
Sandra Case	9 Garden Court Street, Boston
Mrs. F.V.B. Baldassari	328 Hanover Street, Boston
Diane Modica	78 Barnes Avenue, East Boston
Julio Delarri	226 Hanover Street, Boston
Don Aguin	207 East Eagle Street, East Boston
Jenny Watson	EOTC
John Fiumara	165 Endicott Street, Boston
Jack Corrigan	EOTC
Phyllis Gubutosi	145 Commercial Street, Boston
Joseph Gubutosi	145 Commercial Street, Boston
Adriana Trovisa	165 Hanover Street, Boston
Lillian Pessiello	19 Cooper Street, Boston
Josie Gaita	7 Cooper Street, Boston
Willona Glennon	181 Salem Street #118
Josephine Zizza	14 Cleveland Place, Boston
Maria C. Paylinca	357 Hover Street, Boston
Nucleo Eclettico	216 Hanover Street, Boston
Bettina Sgaruno	13 Wiget Street, Boston
Dora Pasquale	23 Clark Street, Boston
Nick Sullo	145 North Street, Boston
Diane Hall	39 Cooper Street, Boston
Frank Masucci	3 Wiggin Street, Boston
Eleanor Johnson	1 Emerson Place, Boston
Jerry Gallotta	99 Fulton Street, Boston 02109
Jo DiGuistini	146 Richmond Street, Boston 02109
Juliana DiGuistini	146 Richmond Street, Boston 02109
Laura Calia	142 Prince Street, Boston 02113
Frank Conte	174 Chelsea Street, East Boston 02128
Albert Tecci	53 Salem Street, Boston
Donald Alummi	78 Prince Street, Boston

NORTH END

ATTENDANCE LIST

NAME	ADDRESS AND/OR ORGANIZATION
S. Anthony DiSimari	176 Endicott Street, Boston
Robert M. Cappucci	176 Orient Avenue, East Boston
Louise Sartori	136 Prince Street, Apt #2, Boston 02113
Robert J. Caprio, Jr.	Columbus High School
Enes Levinson	194 Salem Street, Boston
Alfonso Vicario	194 Salem Street, Boston
Mary C. Freda	5 Baldwin Place, Boston
Rose Marcello	14 Cleveland Place, Boston
George A. Dementt	Mass. Rehab Hospital, Nashua Street, Boston
Giselde Orlandi	120 Commercial Street, Boston 02109
Peter A. Brigham	311 Concord Avenue, Lexington
Alison Brigham	Richdale Park, Cambridge
Rosemary Brigham	Richdale Park, Cambridge
Ruth Kolodney	HFMW
Elizabeth Areogs	Allston, MA
Michael Cappizzi	
Phil Orlandela	Massport
Enzo Satta	
S. Smallridge	
Fred Langone	
Robin Young	
Fred Salvucci	
Matt Coogan	
Len Barbieri	
Frank Astone	
Linda Ross	
Carole Schlessinger	
Antonio DiMambro	
John Yaney	
Natalie Jacobson	
Hilary Bacon	EOTC

MINUTES OF THE WATERFRONT INFORMATIONAL Meeting

THIRD HARBOR TUNNEL/CENTRAL ARTERY EIS/EIR

3 AUGUST 1983

The meeting was opened at 7:10 PM by Matt Coogan, Undersecretary for Transportation and Construction. Mr. Coogan noted that tonight's informational meeting on the Central Artery/Third Harbor Tunnel DEIS/DEIR would present an overview of the project and findings with emphasis on Waterfront/Downtown issues. Questions and comments were encouraged.

Mr. Coogan added that comments for the record could be made at formal public hearings on the project to be held August 8 and 9 at Faneuil Hall. Written comments would be accepted until August 22. He continued by saying that all comments and findings would contribute to Governor Dukakis' decision on a preferred alternative, due sometime after August 29. The final EIS with a preferred alternative is due at the Federal Highway Administration by September 30, 1983.

Mr. Coogan then noted that if the final EIS is accepted, final design would begin in late 1983, with a design phase continuing for several years. (Mr. Coogan cited the example of the Charlestown project which took three years.) Extensive community participation in the process would take place during this phase. At the end of the design phase, a design hearing would be held to decide whether the project should continue.

Using slides, Mr. Coogan described the alternative "families" - No Build, Tunnel only, Central Artery only, and Full Build. He stated that widening the existing elevated structure had been examined but dropped from further consideration due to the potential for extensive negative environmental and social impacts. Mr. Coogan also said that the No-Build alternative would include redecking the existing elevated structure and would cause its own set of environmental impacts.

Gordon Slaney, Project Manager, was then introduced. Also using slides, Mr. Slaney described regional impacts of the project.

Adel Foz, Deputy Project Manager for Planning and Urban Design, spoke about the local impacts of the project. Using an 11' x 14' colored axonometric drawing of the project area, Mr. Foz described the benefits and drawbacks of the project in terms of "trade-offs". He emphasized that during the construction period, six lanes of traffic would be maintained on the elevated artery.

Leonard Barbieri, Deputy Project Manager for Engineering, continued the presentation with a description of construction staging. Mr. Barbieri noted that the Full Build alternatives would take 12 years to build, nine

years for the depression and widening of the Central Artery and three years to construct a Third Harbor Tunnel. Because of the magnitude of the Central Artery portion of the project, the work will be contracted in five, 1,000 foot sections at a cost of $150 million each. Mr. Barbieri noted that major pedestrian and traffic access points would be maintained during construction and that parking lost under the existing Central Artery due to the project would be replaced during construction at other points nearby such as the Government Center garage.

Following Mr. Barbieri's presentation, Mr. Coogan opened the meeting to questions and comments:

Herb Cone questioned the validity of the traffic projections in view of the likely future reduction in the use of cars due to lack of fuel. He stated that an alternative to the use of cars must be developed. Mr. Cone also expressed concern that providing a new Dorchester Avenue would eliminate the possibility of pedestrian use and access to the Waterfront/ Fort Point Channel.

Mr. Coogan responded by saying that the supplementary DEIS states that making better access reduces miles traveled but that the energy analysis in the document showed no basic change in energy consumption. Mr. Coogan continued by saying that new Dorchester Avenue essentially replaces the Atlantic Avenue/Northern Avenue ramps. He added that at present waterside use by the public at Fort Point Channel is limited; the project may actually increase public waterside use in this area.

Phyllis Charlton asked how pollution could be reduced if, during construction, more trucks were in the area and more dust and dirt added to the atmosphere. She also wondered how construction trucks would be rerouted to avoid the North End.

Mr. Barbieri said that one side of the surface artery would be used as a controlled access construction road for all trucks related to the project. In the construction contracts, dust control measures would be specified, such as covers and dampening, and contractors would be required to adhere to these specifications.

Mr. Coogan reiterated that contractors would have to adhere to these specifications. He also mentioned that in the near future, a meeting on construction impacts and strategies would be held at which people could ask specific questions on these issues. Representatives of contractors who have worked on major transportation projects will be available to discuss these issues and methods, and respond to questions.

Mike Deluty asked if the water table would be affected by construction, and, if slurry wall construction had been done before, what were its effects on the water table. He noted that in the Waterfront/Downtown area, the water table was affected by the tides and suggested this tidal problem might make construction and water table maintenance especially difficult. He asked if there would be controls if anything goes wrong.

Mr. Barbieri said slurry wall construction has been used in the past; the Southwest Corridor and MBTA Harvard Square projects are two local examples. Slurry wall construction will stop water from migrating and maintain the water table; equalizing pipes will also be installed. Tidal fluctuation should not affect these construction measures; the system will be designed with this in mind; monitoring will take place. Equalizing pipes will aid water flow around the finished tunnel; water migration necessary to maintain the water table will not be prevented by the existence of the tunnel.

Karen Sumler asked how far the study's evaluation of traffic congestion extended.

Mr. Slaney said the study's traffic analysis extended out to Rt. 128, that this was the decision point at which traffic committed itself to travel into the city.

Mr. Coogan added that the study examined cumulative traffic effect, looking beyond level of service to an evaluation of queues and bottlenecks, a sort of wide angle view of the system.

Ann Deluty wondered about the use of the tunnels by vehicles carrying hazardous cargos.

Mr. Coogan said that the state in cooperation with the city of Boston was developing a policy which would require all hazardous cargo vehicles which were not destined for the city to travel on regional roads outside of Boston. Only hazardous cargo vehicles destined for locations within Boston would be allowed to use roadways within the city, and these would be further required to remain on surface roadways.

Susan Hurt noted that a recent letter in the Boston Globe said during construction the only way to get from the North End to Downtown would be at Haymarket Station, and wondered if this were true.

Mr. Coogan responded that it was not true. All critical links and patterns of movement between the North End and Downtown had been examined in the study and it was a policy commitment of the state to maintain these critical pedestrian and vehicular access points and patterns throughout construction. He added that slight shifts of the paths may be necessary but they will not be closed or drastically moved.

Pat Wells expressed concern that the potential of Fort Point Channel as an amenity will be lost under this project, that existing city plans to create a public promenade in the area do not mix well with plans for a major new roadway. She added that the city has no public landing and Fort Point Channel would make a natural harbor. Fort Point Channel will become more and more important as a "breathing space" for the city as development in the South Station area intensifies. Ms. Wells also noted that Boston was not designed for the auto; similar cities are creating disincentives for autos and incentives for pedestrians and public transportation. She wondered why pass through traffic was being encouraged in the city. She feels ferries and public transit should be encouraged.

Mr. Coogan noted that the Fort Point Channel waterfront essentially would experience change only from Gillette to Summer Street, adding that a new Dorchester Avenue is being examined which would be narrower than the one previously discussed, made one-way north, and on piles, not fill, which would not change the bulkhead line. A public promenade would be possible along this water from South Boston to South Station, an amenity that does not presently exist. Mr. Coogan continued by saying ferries had been examined in the DEIS and were found not to be an adequate option. If a third harbor tunnel were built some of the lanes could be designated for buses only which would go directly to the airline terminals and would be a major commitment to public transit.

Jack Scalcione of the Coalition Against a Third Tunnel stated that the present study was not expansive enough, that it lacked imagination, noting that ferries could carry buses which could then take people to the airline terminals, avoiding the modal change. Mr. Scalcione said CATT supported a ferry system.

Mr. Coogan responded that this was a good comment.

Jeanne Valencius asked about the possible public health impacts of the vent buildings.

Mr. Slaney pointed out the possible locations of vent buildings along the corridor which would be used to provide ventilation for the tunnel and depressed artery. During the design phase, the actual vent building locations, height, and air velocity would be worked out. The vent buildings will localize what occurs along the Central Artery now, discharging the air above the rooftops of neighboring buildings.

Mr. Foz added that on congested roads such as the Central Artery, more carbon monixide is produced; at higher speeds less carbon monoxide is released. Vent building heights and speeds are important in order to sufficiently dilute the pollutants so no standards are exceeded.

Mr. Coogan emphasized that vent building heights and locations will be worked out during the design phase, as promised in the environmental document. The vent building near Harbor Towers will be reexamined.

Boston City Councilor Fred Langone stated he never knew another vent building was being considered at the mouth of the existing tunnels. He noted that the air quality in this area was already poor and that the study should closely examine this fact before any additional vent building went into this area. The Councilor also pointed out that under the original agreement to sell Dorchester Avenue to the Post Office, the Post Office agreed to replace Dorchester Avenue with a viaduct. Engineers studying this matter in 1969 felt that this could not be built because of the fragile condition of the Red Line. Mr. Langone wondered how a structure can be built over the Red Line in the 1980s when it was felt to be impossible in 1969.

Mr. Coogan responded by saying that air quality has been monitored at 40 sensitive receptors for this study including the area near the existing tunnel mouth in the North End. Mr. Coogan then referred to page 212 of the supplementary DEIS, pointing out that 9 parts per million (ppm) of carbon monoxide is considered unhealthy. He noted that, at present, at Martignetti's the reading is 12 ppm and this will rise to 14 ppm in 1990 if the project is not built. With the project, this figure will fall to 5 ppm. Mr. Coogan also said that construction over the Red Line tunnel has been extensively examined and it is possible to do.

The Councilor added that the state and consultants must be honest with the people and suggested that there were alternate ways to deal with traffic. Mr. Langone also stated that on August 8 and 9 labor leaders will come out in favor of the project because it will mean more jobs; he stated that just as many jobs could be created if the money was spent to repair existing roads and bridges.

Jim Kelly asked if any provisions were being made for the recreational use of Fort Point Channel and the landing of boats.

Mr. Coogan said that there would not be a road between Congress Street and Northern Avenue and there will not be a road on the South Boston side of the Channel, allowing points for boats to land. He added that the state could be allowed to spend federal money to build some sort of pedestrian amenity over the tunnel.

Jerry Olanoff asked about techniques available to reduce noise on construction equipment.

Mr. Barbieri described several measures to reduce noise such as noise barriers and working underground. He noted that slurry wall construction is much quieter than pile driving and therefore was the construction method to be used on the Central Artery, adding that work would be done in two, ten hour shifts with the noisiest work forbidden during certain hours near residential areas. Mr. Barbieri admitted, however, that the construction process would be noisy even with these measures, although not as severe as without them.

A woman in the audience asked if it were true that a 1,000 trucks a day would be added to the North End during construction.

Mr. Coogan responded by saying that 1,000 truck trips per week would be generated by construction and these would be restricted to the construction road designated under the elevated structure.

Phil D'Alessandro, a Commercial street resident, commented on the noise generated by the construction of the Mariott Hotel.

Mr. Coogan emphasized that the Central Artery project would not involve pile drawing, only the quieter slurry wall construction method.

Mike Deluty asked if the Central Artery could be put in a tunnel along the shore line.

Mr. Coogan said that the need to go deep under the harbor bottom would make ramp connections to surface difficult.

Jack Scalcione repeated that he felt the study was static in its thinking, that there has not been adequate consideration given to putting people in alternate means of transportation.

Mr. Coogan noted that the Dukakis administration is solidly behind improved transit - the Southwest Corridor is an example. This study is in addition to that effort in an attempt to answer problems not solved by public transit.

Herb Cone stated that public transit is not available to all places, therefore, there is a need to extend public transportation and provide disincentives for automobile use.

Mr. Coogan thanked the audience for attending and offering comments and reminded everyone of the public hearings to be held August 8 and 9 at Faneuil Hall. The meeting was adjourned by Mr. Coogan at 9:30 PM.

WATERFRONT
ATTENDANCE SHEET

NAME	ADDRESS
Ruth Rolodney	HFMW
Mark Siegel	Noymer Mfg. Co.
Ronald Sweet	Noymer Mfg. Co.
Donna Reed	13 Park Street, Charlestown
Peter Brunet	Cong. Ed Markey, Rm 2100A, JFK Bldg.
Christopher J. Morton	Joy Street, Boston
Larry Bluestone	Boston Society of Architects
Ann Wong	Simmons College
Gail Amano	Simmons College
Phyllis Charlton	Mercantile Bldg.
Robert A. Snowber	Parsons Brinckerhoff
Dom D'Eramo	MAPC-Millis
Merilee Wolfson	Commercial Wharf
Karen Alschuler	Skidmore, Owings & Merrill
Andy Gordon	Otis Street, Newton
Pete Briene	6 Perch Avenue, Wayland
Joan Briene	6 Perch Avenue, Wayland
Lucy Ferullo	EOTC
Susan Hern	404 Commercial St, Boston
Jeanne Valencius	480 Commercial St, Boston
Michael Shea	EOTC
Lorraine Downey	City of Boston Environmental Dept.
Diane Modica	78 Barnes Avenue, East Boston
Dan Aguror	207 Eagle Street, East Boston
Beth Brewer	MAAN
Ted Holden	418 Highland, Winchester
Jeffrey A. Pond	142 Commercial Street, Boston
J. Philip Mitchell	20 Kelly Street, Boston
Leslie Burton	19 Fleet Street, Boston
Patricia Winter	P.O. Box 8525, Boston 02114
Deborah Meehan	5115 Eighth Street, Charlestown
Richard Murray	5115 Eighth Street, Charlestown
C.W. Rogers	2 Hawthorne Place, Boston
Michael Arace	80 Leon Street, Boston
David Prerguber	50 Leon Street, Boston
Phil Caruso	BT&P Department
Jerold A. Olanoff	63 Atlantic Avenue, Boston
Carole Sonduch	320 Park Avenue, Arlington
Heidi Stolle and Maria	Conservation Law Foundation
Carole Schlessinger	HFMW
H.J. Smith	RSR Reality, 9 Newbury Street, Boston
Denis Cysdetta	Atlantic Avenue, Boston 02110
Antonio DiMambro	161 Endicott Street, Boston
Morris Englander	Harbor Towers, Boston
Elinor Solet	85 E. India Row, Boston 02110
Ken L. Orton, Lt. USNR	Boston MEPS, 495 Summer St., Boston

WATERFRONT
ATTENDANCE SHEET

NAME	ADDRESS
M. Ashraf Jan	FAA, Burlington
Philip D'Alessandro	OSIA
H.R. Cone	Long Wharf Business, Mass. Ave.
Hope Cranshaw	Ten Emerson Place, Boston 02114
Phil P. Foster	Traffic Dept. City
A.G. Caseul	306 Dartmouth Street, Boston
Normand Smith	BUNA, 63 Atlantic Avenue, Boston
Maryann C. Calea	Office of State Rep. Sal DiMasi
Juliana A. DiGiustini	Office of State Rep. Sal DiMasi
Jo DiGiustini	Office of State Rep. Sal DiMasi
C. Tarazzo	CC&F, 60 State St.
W.C. Upton	CC&F, 60 State St.
Robert J. DelloRusso	Office of State Rep. Sal DiMasi
Louise Lewis	97 Newbury Street, Boston 02116
Rita DiGiovanni	EOTC
Jay Arcand	18 Union Wharf, Boston
Arthur Brooks	P.O. Box 442, Boston
William V. Kihoe	234 River Road, Winthrop
Gina Scalcione	36 Frankfurt Street, East Boston
Jack Scalcione	36 Frankfurt Street, East Boston
M. Coogan	EOTC
G. Slaney	HFMW
A. Foz	HFMW
M. Cappizzi	
L. Barbieri	HFMW
W. Oliver	MDPW
F. Sholock	MDPW
Eamon Connolly	
L. Mercado	HFMW
H.H. Smallridge	HFMW
J. Yaney	HFMW
J. Mansolillo	HFMW
T. Casandino	
F. Douglas	HFMW
Norm Faramelli	Massport
Sam Crisifulli	315 Cambridge Street, Boston
Ann Hershfang	EOTC
Robert Capucci	
M. Konsoulis	HFMW

NOTICE OF PUBLIC HEARING

THIRD HARBOR TUNNEL/DEPRESSED CENTRAL ARTERY ENVIRONMENTAL IMPACT STATEMENT/REPORT

The Massachusetts Department of Public Works will hold a public hearing on the alternatives for a widened and depressed Central Artery and a possible Third Harbor Tunnel as outlined in the Draft and Supplementary Draft Environmental Impact Statements/Reports.

The hearing will be held on August 8 and 9, 1983, from 11 A.M. until 11 P.M. at Faneuil Hall, Boston. Call 727-7680 to arrange to testify.

Copies of the Draft and Supplementary Draft Environmental Impact Statements/Reports are available for public review at the following locations during normal business hours: Massachusetts Department of Public Works, 100 Nashua Street - Room 530, Boston, Massachusetts; Boston Public Library, Government Documents Section, Copley Square; South Boston Branch Library; North End Branch Library; and East Boston Branch Library.

Written comments for inclusion in the Final Environmental Impact Statement/Report must be submitted by August 22, 1983 to Robert J. McDonagh, Chief Engineer, Massachusetts Department of Public Works. 100 Nashua Street, Boston, Massachusetts 02114.

This Advertisement was published in the following newspapers:

1. Braintree Star - July 22, 1983
2. Dorchester Argus Citizen - July 21, 1983
3. Milton Record Transcript - July 22, 1983
4. Hyde Park Tribune - July 21, 1983
5. Jamaica Plain Citizen - July 21, 1983
6. Norwood Times - July 25, 1983
7. Charlestown Patriot - July 21, 1983
8. Braintree Forum - July 28, 1983
9. Brookline Chronicle Citizen - July 21, 1983
10. Boston Ledger - July 25, 1983
11. Allston-Brighton Citizen Item - July 21, 1983
12. The Daily Transcript - July 25, 1983
13. The News Tribune - July 25, 1983
14. Trib-Plus - July 27, 1983
15. The Family Shopper - July 27, 1983
16. Needham Chronicle - July 27, 1983
17. Associated Newspapers - July 27, 1983
18. Armenian Mirror-Spectator - July 30, 1983
19. Parkway and West Roxbury Transcripts - July 27, 1983
20. Newton Graphic - July 27, 1983
21. Somerville Journal - July 21, 1983
22. Cambridge Chronicle - July 21, 1983
23. Watertown Press - July 21, 1983
24. Arlington Advocate - July 21, 1983
25. Watertown Sun - July 21, 1983
26. Belmont Herald - July 21, 1983
27. Revere Journal - July 20, 1983
28. Quincy Sun - July 21, 1983
29. Revere Reporter - July 20, 1983
30. Belmont Citizen - July 28, 1983
31. Chelsea Weekly News - August 4, 1983
32. Dorchester Community News - July 26, 1983
33. Bay State Business World - July 27, 1983
34. Needham Chronicle - July 27, 1983
35. Parkway Transcript - July 27, 1983
36. West Roxbury Transcript - July 27, 1983
37. Waltham News Tribune - July 27, 1983
38. Daily Transcript - July 27, 1983
39. Newton Graphic - July 27, 1983
40. Patriot Ledger - July 22, 1983
41. Winthrop Sun - August 3, 1983
42. Chelsea Record - July 26, 1983

Legal Notices

THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS NOTICE OF PUBLIC HEARING

Public hearings on the Draft Environmental Impact Statement/Report for a Depressed Central Artery/Third Harbor Tunnel Project, Interstate 90 located in Boston, Massachusetts.

A public hearing will be held by the Massachusetts Department of Public Works to discuss the proposed Depressed Central Artery/Third Harbor Tunnel for Boston as contained in the Draft Environmental Impact Statement/Report. The public hearing will be held on two days, August 8 and August 9, 1983 from 11 a.m. to 11 p.m., at Faneuil Hall in Boston, MA. Plans will be on display with an engineer in attendance during this time.

This public hearing will provide the public with an opportunity to become fully acquainted with the Draft Environmental Impact Statement/Report and the proposed alternatives for a Depressed Central Artery/Third Harbor Tunnel. All views and comments made at these hearings will be reviewed and considered in the decision process to the maximum extent possible.

In compliance with the National Environmental Policy Act of 1969, the Department of Public Works has available for public review the Draft Environmental Impact Statement/Report prepared for the project in the following locations during normal business hours:

Massachusetts Department of Public Works
100 Nashua Street
Room 530
Boston, Massachusetts

Boston Public Library
Government of Documents Section
Copley Square, Boston

South Boston Branch Library

North End Branch Library

East Boston Branch Library

Written views received by the Department subsequent to the date of this notice and up to five (5) days prior to the date of the hearing shall be displayed for public inspection and copying at the time and dates listed above. Written statements and other exhibits, in place of, or in addition to, oral statements at the public hearing regarding the proposed undertaking are to be submitted to Justin L. Radlo, Chief Engineer, Massachusetts Department of Public Works, 100 Nashua Street, Boston, MA 02114. Such submissions will also be accepted at the hearings. Public comments will be accepted until August 22.

SANDINO J. TERSIGNI
Commissioner
ROBERT J. McDONAGH
Chief Engineer
Jly 8

This advertisement appeared in the Boston Herald on July 8, 1983.

The same text was published in the following newspapers:

1. South Boston Tribune - July 7 and July 14, 1983
2. East Boston Times - July 6, 1983
3. East Boston Community News - July 12, 1983
4. The Chelsea Record - July 8, 1983
5. The Boston Globe - July 8, 1983

CERTIFIED

this is your advertisement from

The Boston Globe

of SUNDAY, JULY 24, 1983

appearing in classification

LEGAL NOTICE

MISS SIMON

Classified Advertising

THE COMMONWEALTH OF MASSACHUSETTS, DEPARTMENT OF PUBLIC WORKS, NOTICE OF PUBLIC HEARING. Public hearings on the Draft and Supplementary Draft Environmental Impact Statements/Reports for a Depressed Central Artery/Third Harbor Tunnel Project, Interstate 90, located in Boston, Massachusetts. A public hearing will be held by the Massachusetts Department of Public Works to discuss the proposed Depressed Central Artery/Third Harbor Tunnel for Boston as contained in the Draft and Supplementary Draft Environmental Impact Statements/Reports. The public hearing will be held on two days, August 8 and 9, 1983 from 11 A.M. to 11 P.M., at Faneuil Hall in Boston, Massachusetts. Plans will be on display with an engineer in attendance during this time. Call 727-7680 to arrange to testify. This public hearing will provide the public with an opportunity to present testimony on the contents of the Draft and Supplementary Environmental Impact Statements/Reports. All views and comments made at these hearings will be reviewed and considered in the decision process to the maximum extent possible. At 11:15 A.M. on both hearing days, there will be a presentation on the regulations pertaining to relocation as well as a presentation on the contents of the Draft and Supplementary Draft Environmental Impact Statements/Reports. In compliance with the National Environmental Policy Act of 1969, the Department of Public Works has available for public review the Draft and Supplementary Draft Environmental Impact Statements/Reports prepared for the project in the following locations during normal business hours: Massachusetts Department of Public Works, 100 Nashua Street — Room 530, Boston, Massachusetts; Boston Public Library, Government Documents Section, Copley Square; South Boston Branch Library, North End Branch Library; and East Boston Branch Library. Written views received by the Department subsequent to the date of this notice and up to five (5) days prior to the date of the hearing shall be displayed for public inspection and copying at the time and dates listed above Written statements and other exhibits, in place of, or in addition to, oral statements at the public hearing regarding the proposed undertaking are to be submitted to Robert J. McDonagh, Chief Engineer, Massachusetts Department of Public Works, 100 Nashua Street, Boston, Massachusetts 02114. Such submissions will also be accepted at the hearings. Public comments will be accepted until August 22 ROBERT J. McDONAGH, CHIEF ENGINEER. ROBERT TIERNEY COMMISSIONER. Boston, Massachusetts, 21 July 1983.

This same text also appeared in the Boston Herald on July 24, 1983.

COMMUNITY INFORMATIONAL MEETING AND PUBLIC HEARING
THIRD HARBOR TUNNEL/DEPRESSED CENTRAL ARTERY
ENVIROMENTAL IMPACT STATEMENT/REPORT

The Massachusetts Department of Public Works will hold an informational meeting concerning plans for a widened and depressed Central Artery and a possible Third Harbor Tunnel on:

Monday, August 1, 1983, 7 P.M.
South Boston Branch Library
646 East Broadway
South Boston, Massachusetts

The above meetings are to explain the construction alternatives as outlined in the Draft and Supplementary Draft Environmental Impact Statements/Reports on which public testimony will be accepted at a public hearing on August 8 and 9, 1983 from 11 A.M. to 11 P.M. at Faneuil hall, Boston. Call 727 7680 to make arrangements to testify.

Written comments for inclusion in the Final Enviromental Impact Statement/Report must be submitted by August 22, 1983 to Robert J. McDonagh, Chief Engineer, Massachusetts Department of Public Works, 100 Nashua Street, Boston, Massachusetts 02114.

The above advertisement appeared in the South Boston Tribune on July 21, 1983. Similar advertisements were published in neighborhood newspapers publicizing the corresponding community informational meetings.

Newspaper	Neighborhood	Date
East Boston Community News	East Boston	July 12, 1983
East Boston Times	East Boston	July 13, 1983
Post Gazette	North End, Waterfront	July 22, 1983
East Boston Times	East Boston	July 20, 1983
Bay State Banner	South End/Chinatown	July 21, 1983
South End News	South End/Chinatown	July 21, 1983

APPENDIX 2:
CONCEPTUAL RELOCATION PLAN REPORT

APPENDIX 2:

CONCEPTUAL RELOCATION PLAN REPORT

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CONCEPTUAL RELOCATION PLAN REPORT

1.0 INTRODUCTION

The purposes of this report are to identify and examine the business relocations necessitated by the depressed Central Artery and Third Harbor Tunnel. The report examines several variables for each business including type of business, space requirements, and optimum relocation needs in order to assess the impacts of relocation on the businesses involved and to flag any difficulties that might arise as a result of the relocation.

Data on the businesses affected by each alternative were gathered primarily from interviews with a business representative (usually an owner or manager) conducted at the site (see Table 1 for the list of questions asked during the interview). In instances where a building had multiple tenants, the building owner was asked to supply information on the various businesses if he felt that interviewing his tenants directly would have a negative effect on his ability to keep tenants.

Other portions of the plan describe available replacement properties, business-related economic impacts, community economic impacts, public and private involvement in helping to minimize economic harm, the role of relocation workers in assisting relocating businesses, and the benefits for which the business and building owners are eligible.

In the discussions which follow, all references to acquisition of properties or buildings refer only to those properties or buildings whose tenants'/owners' businesses will be displaced by the proposed project. Other property acquisitions will occur as part of this project, but will not involve business displacements. Where mitigating measures are necessary to ensure the continuance of business operations during the construction phase, they are discussed in Section 4.4 of the Final Environmental Impact Statement and Report (FEIS/FEIR) LAND USE IMPACTS.

1.1 Summary of Findings

No residential units will be displaced by the Preferred Alternative, and therefore no residential relocations will be required. The No-Build (or Redecking) Alternative would affect the nine parking lots located under the Central Artery. It is expected that not all of the lots would be affected at the same time, but all would be closed at some point during the three-year construction period.

The Preferred Alternative requires 31 partial or total takings necessitating the relocation of 131 businesses and 4,400 employees. The nine parking lots under the Central Artery would be entirely taken during the twelve year construction period. It should be noted that the Anelex Building taking accounts for 62 of the total businesses/agencies and 2,200 of the total number of employees affected by this project. It should also be noted that the Stop and Shop Bakery employing about 300 persons, is also included in this total; recently, however, the Stop and Shop Bakery announced plans to relocate from the present facility.

Table 2 and Figures 1-4 elaborate on these findings.

1.2 Points of Clarification

The Boston Garden, located next to the Anelex Building on Causeway Street, will not be taken; however, it leases 39,200 square feet of space at the Anelex Building and depends on the availability of office and storage space. In addition, truck deliveries to the Garden pass through the Anelex Building via a ramp from the Anelex parking lot to the building's second floor and then through an enclosed above-grade passageway between the two

buildings. The Anelex taking requires that relocation space and comparable delivery access be provided for the Boston Garden to ensure that none of its operations are disrupted.

The Stop and Shop Bakery uses the entire six-story facility at 226 Causeway Street in the North Station area for the manufacture of bakery goods and their region-wide distribution. With the exception of the one-story loading area which juts out from the building's northwest corner, the remainder of the building itself is not affected. The Preferred Alternative takes the one-story loading area. It appears, however, that an access road could be built from North Washington Street to the north of this building (using part of the present Charles River Building site) with a temporary loading dock area also provided in this area. Truck maneuvering space would be provided. This approach could permit the Stop and Shop Bakery to remain in operation. If this is not determined to be acceptable to the Stop and Shop Co. during the design phase, then truck distribution of goods, a vital part of the business' operation, would be difficult or impossible during construction. (The Stop and Shop Bakery has announced plans to move its operations independent of this project. The building could continue to be used, although some of the land takings may impede trucking capability at the site after construction.)

Several measures could be undertaken during construction to allow the business continued operation. These would include a reconfiguration of the loading area, possible project construction modifications, and/or the availability of comparable space nearby for loading and truck storage purposes. The options will have to be explored more fully during the design phase of this project. Relocation of this, or any future business in this building, cannot be ruled out at this time, however, owing to the uncertainty of maneuvering numerous large trucks in a confined area and decisions by the owner regarding the suitability of mitigating measures.

A partial taking at the Robie Airport Park (161 Prescott Street) adjacent to Logan Airport in East Boston will affect two businesses, an Avis car maintenance facility, and Federal Express. In addition, an annex which is usually occupied by an airport-related tenant, but is currently vacant, will also be taken. It is usually occupied by an airport-related tenant but is currently vacant. It is uncertain whether the taking is significant enough to require that all of the businesses be relocated; the property owner insisted that his tenants not be interviewed unless the project was certain to proceed.

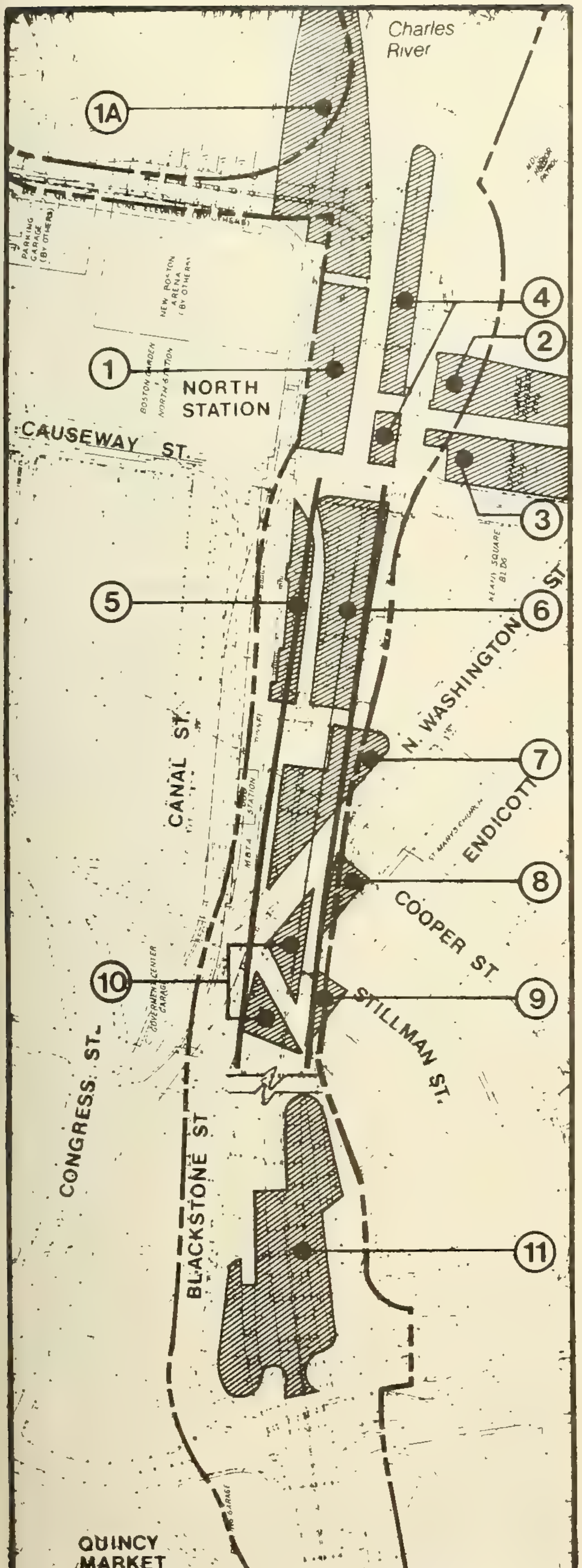
2.0 DESCRIPTION OF THE BUSINESSES AFFECTED UNDER EACH ALTERNATIVE

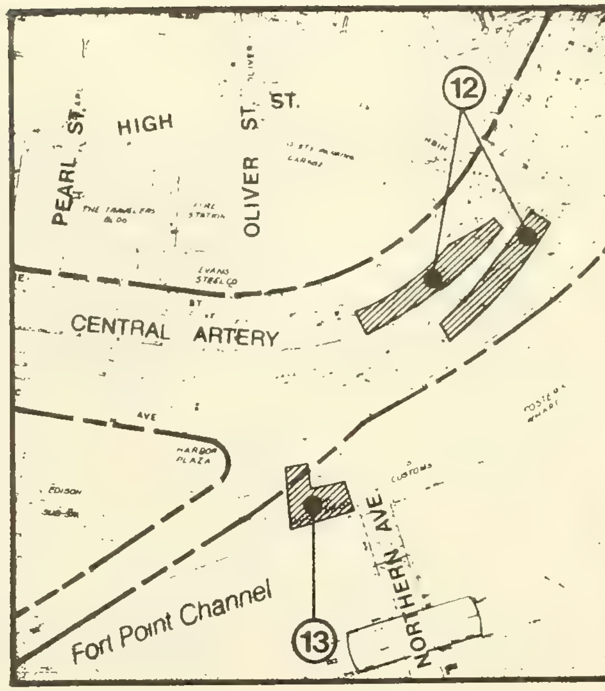
An inventory of the businesses affected by the proposed alignment follows, presented in terms of function, employee profile, and special operating requirements. Refer to Table 2 for a summary of these businesses.

2.1 Central Area

The Stop and Shop Bakery located at 226 Causeway Street is listed as a potentially displaced business, although the building itself is not taken (see Figure 1, #3) and the Bakery has recently announced plans to move from this site. The business manufactures bakery products and distributes them to over 120 Stop and Shop or related stores in New England, New York, and New Jersey. Other food chains also purchase and distribute these goods. A discount bakery selling surplus bakery products and catering to local residents and area employees also operates at the site.

Approximately 300 persons work at the bakery; the bulk of employees are involved in labor-intensive manufacturing operations. Thirty-seven employees reside in the





Legend

1	150 Causeway St.	Primarily Office, some Storage & Retail (62)
1A	150 Causeway St	Parking
2	131 Beverly St.	Primarily Manufacturing & Warehouse
3	226 Causeway St. (Loading Dock Only)	Bakery Manufacturing & Distribution
4	Beverly St. Lot (proposed)	Parking
5	Haverhill St. Lot (1 of 2 parcels)	Parking
6	Causeway St. Lot	Parking
7	North Washington St. Lot	Parking
8	Cooper St./Stillman Place Lot	Parking
9	Endicott/Stillman Street Lot	Parking
10	N. Washington/Cross/New Chardon Street Lots (2)	Parking
11	Blackstone/North/Cross St. Lot	Parking
12	Purchase/High/Atlantic St. Lots (2)	Parking
13	15 Northern Ave.	Lobster Wholesale Retail

Note: Numbers in parenthesis indicate the number of businesses displaced, if more than one

Proposed Project Construction
Business Relocation
Approximate Tunnel Wall

Figure 1
Relocation Requirements
Area North of Dewey Square

0 200 400 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

North End and Charlestown.

The six-story building utilizes over 200,000 square feet of floor space. Warehousing, some office space, and the discount bakery are located on the first floor, while manufacturing takes place on the upper five floors. The business requires heavy live load capacities and high ceiling space to accommodate machinery, and sufficient lot space or other property for trailer truck maneuvering and parking. Proximity to major roads and to an adequate source of labor is also required.

The Anelex Building at 150 Causeway Street is a 13-story building used primarily for office space with retail uses on the ground floor (see Figure 1, #1). The property also includes a 440-car lot located in the back (see Figure 1, #1A). The building contains 504,000 square feet of leasable space and accommodates 62 tenants, approximately half of whom are public agencies. Key public offices include the Coast Guard, Interstate Commerce Commission, Registry of Motor Vehicles, and the Department of Social Services. Major private businesses located at 150 Causeway Street include the New Boston Garden Corp., Boston and Maine Railroad, Anderson-Nichols, and Boston Sand and Gravel Co. Two thousand, two hundred (2,200) employees work at the building.

The Anelex building is considered desirable because of its location which is near downtown Boston, opposite North Station, and immediately adjacent to major roads, and because of its access to affordable parking. Because the North Station area has yet to undergo renewal and because space at 150 Causeway is not Class A (a rating which indicates that the building has new or completely renovated "top quality" office space, a prime location, and therefore highly competitive rents), rents are considerably lower here than in other downtown locations.

The Charles River Building at 131 Beverly Street (see Figure 1, #2) is a nine-floor brick building providing 180,000 sf of manufacturing and warehousing space to eight tenants with a total of 260 employees. Two floors are vacant. Tenants are Laurelite Manufacturing Company, Inc., a lighting fixtures manufacturer and assembler; Wynco Distributor, a tile distributor; Blauer Manufacturing Company, Inc., a coat manufacturer; Copley Business Service, a mailing service; Addison Getchell Company, a printing firm; and Machine Composition Company, a typesetting service. Storage space for Massachusetts General Hospital and the Department of Mental Health is also located here.

The owner estimates that about 20 percent of the building's employees live nearby in either the North End or Charlestown. The businesses require large live load capacities and high ceilings for heavy equipment, freight elevators and loading docks.

Nine parcels under the Central Artery between High Street and Beverly Street, owned by the Commonwealth and the City of Boston and used for surface parking, are taken (see Figure 1, #s 4-12). These spaces would also be partially or totally taken for the duration of any redecking scheme for the Central Artery. Together they have a capacity for over 725 cars and cater to the areas they abut.

Not all of the lots require attendants; some require stickers or special permits instead. In all, over 30 employees will be affected by the lot takings. These include full- and part-time employees and those hired to work on a seasonal basis or for special events.

- Purchase/High/Atlantic Street Lot (2 parcels operating as 1 lot). This lot operates five days a week and serves the business community. 70 spaces.

- Blackstone/North/Cross Street Lot. Open 24 hours a day, this lot caters to general users on

weekdays; North End and Haymarket shoppers on Fridays and Saturdays; and to the restaurant, hotel, Quincy Market, and Boston Garden trade during evenings. In addition, 50-75 North End residents park here on weekdays. On street cleaning days in the North End an additional 50-75 residents park their cars here for free. 207 spaces.

- North Washington/Cross/New Chardon Street Lot. (2 parcels serving as one lot) These lots provide sticker parking for North End stores whose patrons and employees were recently denied street parking in the North End due to a new resident-parking-only policy. 65 spaces.

- Endicott/Stillman Street Lot (known as Castignetti's lot). Same as above. 20 spaces.

- Cooper Street/Stillman Street Lot (known as Tecce's). This lot serves local residents. 20 spaces.

- North Washington Street. This lot is used for general parking during the day and provides parking for Boston Garden activities and the North End restaurant trade during evenings. 61 spaces.

- Causeway Street Lot. This lot is used daily for general parking, particularly by members of the business community in the North Station area or by persons who drive to North Station and then take mass transit to other sections of downtown Boston. During the evenings it is used by persons attending Boston Garden events. 122 spaces.

- Haverhill Street Lot (half of the two lot parcel is taken with the Preferred Alternative). During the day this lot is used by City of Boston employees. In the evening the lot serves local restaurant clientele and persons attending Boston Garden events. 49 spaces.

- Beverly Street Lot. This lot will open during evenings beginning in September. It provides parking for Boston Garden events. 60 spaces.

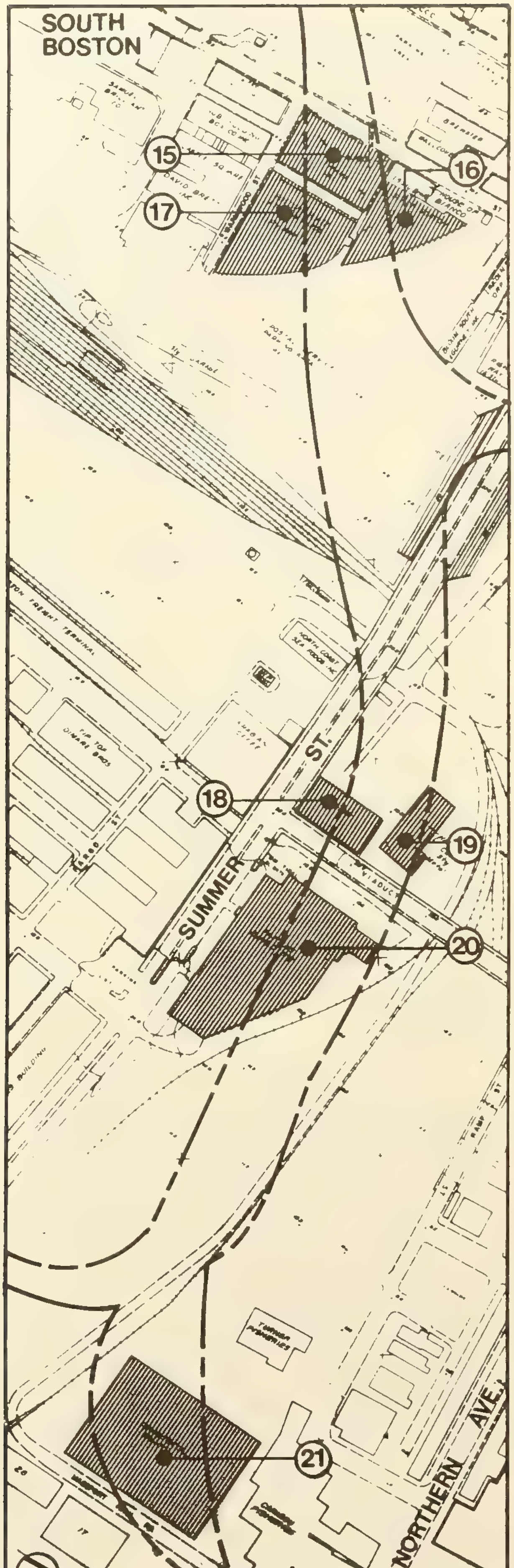
Hook Lobster will also have to relocate under this alternative (see Figure 1, #13). This business receives live lobsters primarily from Maine and Canada which are then distributed to Boston area restaurants, and to other sections of the country by truck or plane. Hook Lobster also has a walk-in retail trade. The business requires a water frontage in order to circulate fresh sea water through its lobster tanks. At the corner of Atlantic and Northern Avenues, Hook Lobster has an optimum location with immediate access to major highways, to Logan Airport, and to nearby seafood restaurants. The business hires about 16 employees, many of whom reside in communities to the south of Boston.

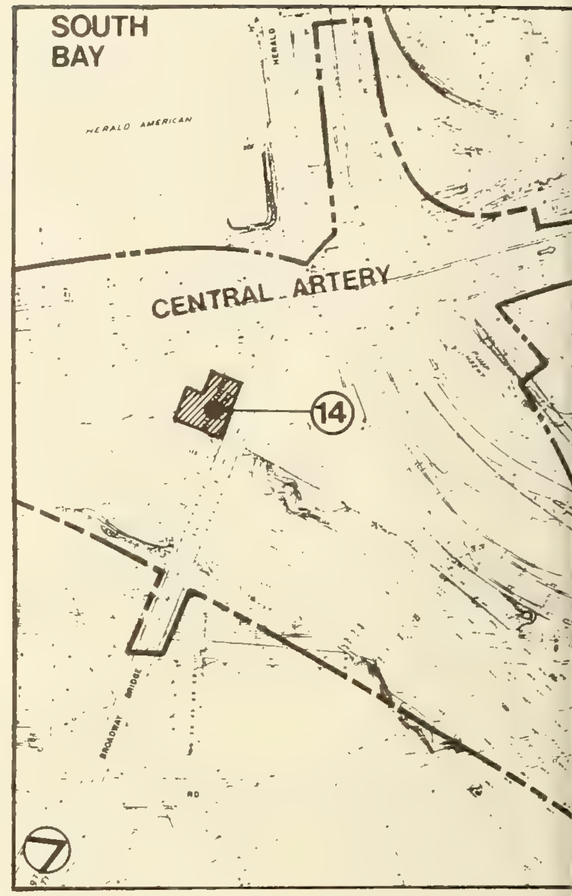
2.2 South Boston/South Bay

The Rapid Service Press Building at 375 Broadway houses two businesses (see Figure 2, #14).

Rapid Service Press utilizes 40,000 square feet of floor space. The firm employs 60 people, several from the Boston area, and a majority who commute to work from the South Shore. There is little employee turnover, and many employees have developed special skills. Special requirements for this establishment include parking and loading space, signage, about 5,000 square feet of high ceiling space, and temperature control in rooms with heavy equipment. Rush orders require quick access to major roads.

Snyder Leather operates a leather warehouse in the same building





Legend

14	375 Broadway	Printer/Warehouse (2)
15	275 A Street	Parking
16	295 A Street	Fish Distributor
17	40 Wormwood St.	Glass/Metal Fabrication; Wooden Skid Manufacture
18	430 Summer St.	Manufacturer/Importer of Leather Goods
19	335 B St. Extension	Hoisting/Rigging Manufacture & Retail
20	440 – 450 Summer St.	Office/Manufacturing/ Warehouse (7)
21	30 Trilling Way	Warehouse/Manufacturing

Note: Numbers in parenthesis indicate the number of businesses displaced, if more than one

Proposed Project Construction

Business Relocation

Figure 2
Relocation Requirements
South Boston/South Bay Areas

0 100 200 400 Feet

and occupies 30,000 square feet of space. The business employs between 10-20 people; most of them commute via public transit. The business' most important relocation requirements are that its building be secure and fire resistant (a fire damaging the business' stock could put the entire warehouse and its client stores out of business for at least a year). The warehouse also requires two loading bays, minimal parking, access to rapid transit facilities, and proximity to an appropriate labor pool.

In the South Boston section of the alignment, the following buildings and/or businesses are taken.

Boston Plate and Window Glass Company and a tenant which manufactures wood skids will have to relocate when the one-story wood building at 40 Wormwood Street is taken (see Figure 2, #17). Boston Plate and Window Glass Company is a glass and metal fabrication company which also warehouses and distributes its products. The firm's 15 employees commute to work from various sections of Metropolitan Boston. Relocation requirements include parking for trucks and cars, high ceilings for fabrication purposes, and 40,000 square feet of space for office and manufacturing uses. A location in the immediate area would be preferred. The other business in this building requires 5,000 square feet of space and has two employees.

The two story building at 295 A Street occupied by Slade Gorton Company, a distributor of frozen seafood, will be taken (see Figure 2, #16). The building occupies 50,000 square feet, of which 35,000 is used as refrigerated warehouse space. Another 15,000 square feet is used for office space. The firm uses nine loading docks. Other requirements include the accommodation of fork lifts, proximity to highways, and a location which tolerates heavy trucking. The firm would prefer to relocate in the same vicinity because it is considered a fish distribution center and benefits from its present location near other fish distribution businesses. Sixty-five employees work at Slade Gorton. Five reside in South Boston, 15 in Dorchester and the remainder live largely in communities south of Boston.

The Solomon Parking Lot, 38,000 square foot surface lot with a 100 car capacity will be taken at 275 A Street (see Figure 2, #15). It has two part-time employees.

The Harding Company located in a one floor aluminum building at 335 B Street Extension will be taken under this alternative (see Figure 2, #19). The company supplies and manufactures hoisting and rigging applications. Most of the 21,000 square feet of floor space is used for manufacturing operations. Other requirements include heavy live load capacities and high ceilings to accommodate heavy machinery such as an overhead crane, truck loading areas, and parking spaces for its 16 employees. The firm has an established reputation in the area and prefers a location in the immediate area.

Noymer Manufacturing Company (see Figure 2, #18) is a manufacturer and importer of leather goods. Of its 75 employees, approximately 60 people are involved in shipping or factory work. Twenty-one employees reside in South Boston, and thirty-one employees are from other sections of Boston including Roxbury, Dorchester, and Brighton.

Noymer currently utilizes 30,000 sf of space and is considering the construction of additional factory space on its property. The business prefers to remain in a similar location near an appropriate labor pool. Because they have a small showroom, a similar location would also provide safe and immediate access for clients, many of whom visit Noymer when they are in downtown Boston for other reasons. The company also requires a manufacturing area on one floor, loading docks, and truck access.

The Pappas Building (see Figure

2, #20) leases approximately 300,000 sf for multiple uses. Currently there are six tenants, although space is available for additional users. Pappas Enterprises serves as the administrative headquarters for several of their concerns which are located elsewhere. Approximately eight of their 25 employees reside in East Boston. The largest tenant, Spencer Shoe (115,000 sf) is a wholesaler and distributer of footwear. Almost half of the ninety employees live in Boston, about twenty of this total reside in South Boston. Their relocation requirements include parking, truck access, and access to the appropriate labor pool. Low rent is another important factor. Provost Lefebvre occupies 1200 sf and is a retailer of woolen products. The business prefers a location area near downtown and client parking.

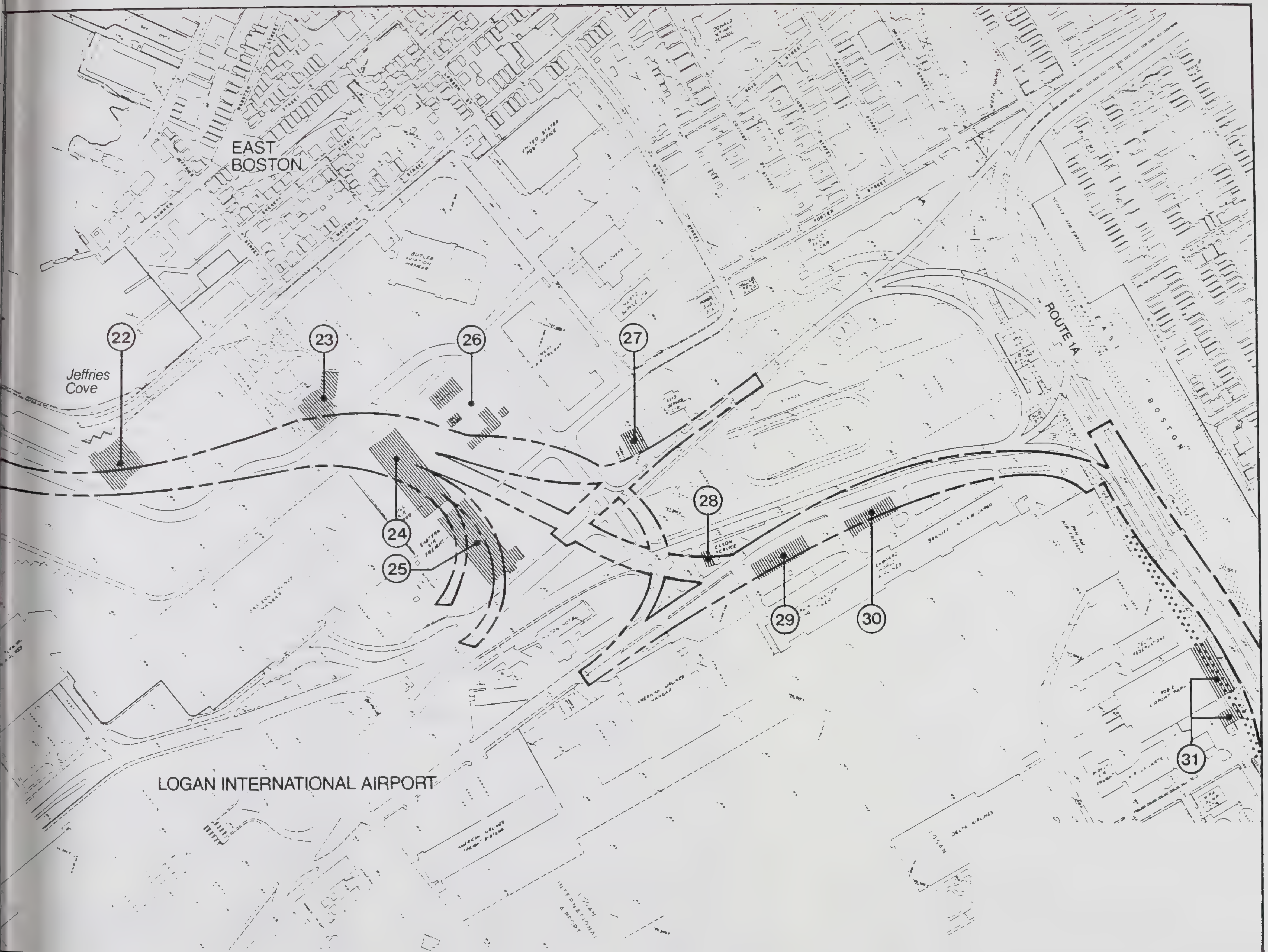
Wardrobe Maker, PPG Industries, Massachusetts General Hospital, and Color Film Corporation are also located in the Pappas Building. Wardrobe Maker, a garment business, cuts material and ships the finished product. Some sewing is done at the facility, but most is done elsewhere. Most of the 80 employees are involved in shipping and material cutting or stitching and the majority of the 50,000 sf of space is allocated to these activities. The business requires access to rapid transit, proximity to the appropriate labor pool, and loading bays. Massachusetts General Hospital operates a major material depot for their supplies. The 25,000 sf warehousing facility must be in a secure area and readily accessible to Massachusetts General as numerous deliveries are made to the hospital each day. Five of the six employees live in Dorchester. PPG Industries sells glass to car dealers and builders. Although only 2 of their 16 employees reside in Boston, they prefer the South Boston location because it is perceived as a safe neighborhood, it puts them in the center of the businesses they deal with, and provides them with immediate access to major roadways. Color Film Corporation provides duplication services for film and video. The business employs seven persons, two of whom reside in the North End, and occupies 2,000 sf of floor space. Because many of their clients are located along Route 128 the business is not restricted to a downtown location.

The Commercial Union Insurance Company building (see Figure 2, #21), is a 120,000 sf one-story building in which services such as printing and warehousing are provided for company offices in the Boston area including those at the Federal Reserve Building and at One Beacon Street. Eleven of the 63 employees reside in Boston. The business requires a one floor building consisting mostly of warehouse space with high ceilings. Loading bays and parking are also required. A South Boston location is preferred as this location provides them quick access to other Commercial Union offices and they find the neighborhood desirable.

2.3 Logan Airport/East Boston

A total of 23 businesses involved in some aspect of freight forwarding (international or domestic carrying, surface forwarding, freight transfer and consolidation, customs brokering) are affected by the proposed project. The businesses are identified in Table 2. Three buildings at the Airport, the Hill Air Cargo Building with 12 businesses, the Eastern Air Freight Building with 3 tenants will be taken as will the Central Air Freight Terminal with 7 tenants (see Figure 3, #s 24, 25, and 29 respectively). A partial taking at the Robie Airport Park adjacent to Logan Airport affects two businesses (see Figure 3, #31)- a car rental maintenance lot and a freight forwarding business (see Points of Clarification). Less than 10 percent of these employees reside in East Boston while the majority of others reside in communities north of East Boston (Malden, Revere, Lynn, Melrose etc.).

The Hill Air Cargo Building an



Legend

22	Logan Airport	Flight Reservations; Office
23	Logan Airport	Primarily Office (4)
24	Logan Airport	Freight Forwarders (12)
25	Logan Airport	Freight Forwarders (3)
26	Logan Airport	Car Rental
27	Logan Airport	Car Rental
28	Logan Airport	Service Station
29	Logan Airport	Freight Forwarders (7)
30	Logan Airport	Flight Kitchen
31	161 Prescott St.	Freight Forwarder; Car Maintenance

Proposed Project Construction

Business Relocation

Relocated MBTA Blue Line

Note: Numbers in parenthesis indicate the number of businesses displaced, if more than one

Figure 3

Relocation Requirements

East Boston/Logan Airport

0 200 400 Feet

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

the Eastern Air Freight Building also contain leasehold improvements (i.e., improvements constructed by the tenant) that will revert to Massport upon termination of ground leases.

Most of the businesses affected by this alignment require an airport location. In some cases, airside access, frequent airport trips, or client preferences necessitate this. In other cases, it is very convenient and lowers costs because business associates are also located there, or the businesses feel that such a location offers them competitive and marketing advantages. Special requirements include adequate parking, loading bays and security. Some of the carriers also require both landside and airside frontage.

Two car rental facilities are displaced as a result of the Preferred Alternative. The Hertz facility (see Figure 3, #27) serves as an express center with counter space, a small office area, and a lot for up to 75 cars. Fifteen employees work at the site. The business representative felt their operation would have to relocate even with a partial taking as lot space is intensively used.

The main facility for National Car Rental (see Figure 3, #26) is taken affecting a 150,000 sf parcel including an administration building and a building for minor car maintenance work. Of the 120 employees, 13 are from East Boston, and many others reside in nearby East Boston communities.

The General Aviation Building, with about 25,580 sf of leasable space, will also be acquired (see Figure 3, #23). The Massachusetts Aeronautics Commission, which will move to the new State Transportation Building upon its completion, may retain a small office at Logan. Four remaining tenants will be affected (four tenants recently relocated to Bird Island Flats). Aerial Photos International rents 1000 sf of storage space. After several internal changes the Federal Aviation Administration (FAA) presence will be reduced to a staff of about 21 airway facilities personnel utilizing 3200 sf. Special requirements include parking, access to Logan Airport, and access to the Boston Air Traffic Control Terminal. The National Weather Service operates a forecasting service onsite. It employs 35 persons and utilizes 4766 sf of computer and office space. Although only a small office is required at Logan to determine sky conditions and visibility, the weather service prefers the Airport location. Finally, a 600 sf cafeteria with three employees will also need to be relocated. Massport plans to take approximately 1000 sf of the building to make way for a service road to Bird Island Flats. The remaining space will probably be leased for general office use.

The Eastern Reservations Center, a 50,000 sf building may also be taken (see Figure 3, #22), unless it turns out to be possible to underpin the building during construction. The 430 employees, 10 percent of whom are from East Boston and a majority of others from communities north of Logan Airport, handle reservations for all of New England and upstate New York. The two-story building has extensive sound-proofing to deflect airport noise, and to accommodate numerous reservations operators who work in close proximity to one another. The building must also accommodate telephone lines and computer wires requiring temperature controls and raised floors. The Reservations Center requires parking for up to 400 cars. The Eastern facility subleases 1000 sf to a four-person sales office for Continental Airways.

The United Air Flight Kitchen provides catering services for several airlines including United (see Figure 3, #30). The 12,000 sf facility has 70 employees. This activity must be located at the airport.

The Exxon Service Station is also listed as a displacement under this alternative (see Figure 3, #28).

The station employs 14 people. If the business continues to cater to Logan Airport, it must be located on the main egress. This is an important consideration because airport users tend to buy fuel upon leaving the airport.

3.0 AVAILABILITY OF SPACE FOR RELOCATED BUSINESSES

An analysis of comparable relocation space for each of the displaced businesses is summarized below. Examples of available business space are listed in Table 3 at the end of this report.

3.1 Central Area

The Anelex Building represents one of the largest concentrations of Class B/C (a rating which indicates that the building is old, does not offer "first class" office space, and therefore has more competitive rents) office space in the Central Business District. There is not a great deal of such space presently vacant and available at competitive locations to handle all of the required relocations from this building. However, there are a number of building conversions in less competitive locations which are anticipated, especially in the Fort Point Channel area and on lower Washington Street. Other buildings in the North Station area are also being converted from current uses such as storage, showroom, or manufacturing space to office space. While there are no specific relocation areas in North Station to accommodate the 440 car lot, in the long term some of the spaces could be replaced by building a garage on state-owned property in the vicinity of Haverhill Street (above the MBTA Orange and Green Lines). In addition, Phase 1 of the North Station development plan calls for parking to serve the North Station area.

The building's largest tenant, the U.S. Coast Guard, is scheduled to move to the U.S. Customs Building on Atlantic Avenue upon completion of that structure's renovation. The Small Business Administration may also relocate to this building. Adequate federally-owned office space is expected to be available to accommodate federal offices in the Anelex Building displaced by the project. This space could include the 11-story, 602,000 sf federal office building currently under construction at North Station. In addition, the Registry of Motor Vehicles may relocate to the Registry's main facility at 100 Nashua Street in Boston in the future. The Registry and federal agencies with relocation options which include moving to government buildings will reduce the amount of competition faced by tenants desiring to move to comparable space in privately-owned buidings.

There are a number of industrial sites, both freestanding and in industrial parks, to which the Stop and Shop Bakery might relocate if it is determined during the design phase that acceptable temporary loading facilities cannot be provided. While there are few existing facilities or appropriate parcels upon which to build within the Route 128 area, numerous parcels are available throughout the Interstate Route 495 area which are appropriate and provide convenient regional access. As indicated previously, the Bakery has recently announced plans to relocate its operations from this site independent of this project.

Relocation space is available in Boston for Charles River Building tenants. The market for mill-type industrial space in Boston is very active, especially in the South Boston/Fort Point Channel area.

Parking lot operators on city and state owned land under the Artery run several lots or other businesses, so the possibility exists for employee transfers. Most of the lots are run by operators who bid for them on a yearly basis, and lease agreements stipulate a 30-day or 24-hour notice to terminate. Therefore, these employment opportunities are already short-term in nature.

There is ample vacant land available with water frontage on Reserve Channel at King Industrial Park to accommodate Hook Lobster.

3.2 South Boston/South Bay

Businesses at the Rapid Service Press Building should be able to find comparable space within close proximity of their existing locations. In addition, the comparable space described for the businesses in the Charles River Building also applies to tenants at the Rapid Service Press Building.

There are a number of possible relocation resources for the office manufacturing, processing, and warehousing concerns that will be displaced by the project in South Boston. Examples of space include vacant buildings on Summer and Wormwood Streets, such as 290,000 sf at the former Hub Folding Box Company on Wormwood Street (3 buildings), 90,000 sf of space at the Morton Shoe Building on Summer Street, approximately 800,000 sf now being leased by Economic Development Industrial Corporation of Boston (EDIC) at the new industrial center at the former Boston Army Base. Plans also call for redevelopment of an additional 825,000 sf at Building 114 by one or more private developers at the Army Base which EDIC auspices.

The Boston Marine Industrial Park and the Boston Army base are owned by EDIC. During coordination meetings with EDIC, the agency indicated its intent to make every effort to find a place for businesses displaced by the project in one of its industrial parks or at suitable locations within the City.

There is currently no vacant land for sale or lease within the immediate neighborhood of Solomon Parking. The area is desirable to investors and speculators for future development, and parcels being held for development are already being used on an interim basis for off-street parking or other uses. It is unlikely that this business can be relocated within its present neighborhood.

3.3 Logan Airport/East Boston

Massachusetts Port Authority has indicated its intent to assure the continued operation of affected businesses on alternate sites on Airport property. Massport has several potential relocation sites: portions of still undeveloped land at Bird Island Flats (BIF), 6-12 acres on the north side of the Airport near Neptune Road, and about 8 acres in the Airport's southwest section.

If it proves unfeasible to underpin the Eastern Reservations Center during construction, relocating the building prior to construction to a new site immediately adjacent to the existing site will be considered.

Most of the other businesses would prefer and/or require an Airport location. Space will be available at Bird Island Flats (BIF) to accommodate the freight forwarding businesses (Massport plans call for 440,000 square feet of such space at BIF). Massport is also considering the expansion of cargo facilities in the north area of the Airport. Costs to rent or build new facilities at these sites could be higher than current rents, thereby posing a problem for some of the existing tenants.

The freight forwarding business at Robie Airport Park has the same relocation options as those forwarding businesses located at the Airport. Space is available along Route 1A for the relocation of the Avis car maintenance facility should it prove necessary for these businesses to relocate.

3.4 Related Business Economic Impacts

Despite the availability of replacement property and other relocation benefits which are discussed later in this report, it is useful to note some particular concerns identified during interviews

related to business displacement. It is difficult to do a more systematic analysis of the cost differential relocated businesses may experience because owners are reluctant to reveal their expense portfolios at the conceptual stage of such a project.

Longer-term property owners with favorable (if any) remaining mortgage payments will experience significant cost increases if they choose to construct a new building to specification. Present tenants with advantageous long-term leases will probably experience an increase in rents as a result of having to negotiate a new contract elsewhere. For example, Spencer Shoe has been in the Pappas Building since its construction in 1962; the business had a 20 year lease with a 16 year option to renew. Rent anywhere else would likely be significantly higher than the current rent level. Still other long-term renters who modified their properties may not be reimbursed for improvements unless specific measures were stipulated in lease agreements.

Impacts may be most severe for some of the manufacturing and warehousing businesses located in South Boston including: Wardrobe Maker, Noymer, Harding, Slade Gorton, and Commercial Union Insurance Company. Unlike office furniture which can be moved quickly, manufacturing or warehouse businesses have heavy equipment or intricately stored material which cannot be moved easily, thereby creating the potential or likelihood for business disruptions during relocation. Possible halts in operations can be costly for individual businesses, and this type of loss is not covered by relocation benefits. These relocations are also very disruptive for businesses that ship nationwide and whose goods must be depended upon even while such a difficult move is in progress.

Because such businesses contribute to the diversity of Boston's economic base, it is important to consider the provision of special incentives to businesses to help them recoup any losses and to ensure that they relocate in the immediate area (which most of those interviewed appeared to prefer). This may be encouraged by specific initiatives taken at the city level such as tax abatements, low interest loans, and the provision of technical assistance. These options will be explored more fully in the design phase.

It is also important to give as much prior notice as possible to businesses who will have to relocate. Based on interviews with the business representatives, it is estimated that at least 18 months to 2 years following property acquisition will be needed to carry out a timely and orderly relocation program. This time period is necessary to enable some of the businesses to negotiate land purchases or leases, to build to required specifications, and to schedule the move for a time when it will be least harmful.

4.0 COMMUNITY AND ECONOMIC IMPACTS

Property takings of the Preferred Alternative requiring the relocation of businesses along the alignment result in a total tax loss of up to $767,000 a year. However, long-term impacts of the proposed project on local property taxes are estimated to include a $5-$10 million annual property tax benefit after full absorption of the 2.75 million sf of air-rights development (excluding parking and open space) that is expected to become available above the depressed Central Artery. In addition, a $20-$30 million one time receipt (not annual) will result because of a faster absorption of space in new South Boston developments as stated in Section 4.6 of the ECONOMIC IMPACTS of the FEIS/FEIR.

As stated previously, it appears to be possible to provide temporary loading facilities for the Stop and Shop Bakery to allow its continued operation during construction. However, if the Stop and Shop Bakery does relocate (as it

has recently been announced it would, independent of this project), it will probably move to or build a more modern facility in Boston or along Interstate 495, leaving open the possibility of job losses among a portion of its 300 employees of whom 25 are from the North End, 12 from Charlestown and 90 others from different sections of Boston. Eleven percent of the work force is minority. Because the majority of employees are involved in labor intensive activities, some job loss would likely result because of automation. If the business relocates outside Boston, some employees may be unable to commute to the new location. Similar employment opportunities may be difficult to find in a city where manufacturing jobs are being replaced by service and other office jobs. In other instances, job accessibilty for employees of other displaced businesses should be maintained as businesses can probably relocate in the same vicinity.

Of the nine parking lots taken under the Central Artery, the lot bordered by Blackstone, Cross, and North Streets may cause the most adverse economic impacts because of its convenient location to North End activities. If comparable space during weekdays were not available, some people may be discouraged from dining or shopping in this area. The Commonwealth is committed to provide replacement parking prior to loss of parking at this site to avoid adverse community and economic impacts (see Section 4.4 LAND USE IMPACTS in the FEIS/FEIR).

For the remainder of the takings in the central area, South Bay, and South Boston, numerous locations nearby the existing businesses are available; therefore adverse economic impacts are not expected to result. In South Boston manufacturing and industrial jobs are actually expected to increase due to the current redevelopment of space at the Boston Army Base and due to roadway improvements built as a result of the Preferred Alternative. These improvements will also increase revenues in the long term.

In East Boston there are no significant community economic impacts because it is anticipated that most businesses would relocate at the Airport, thereby preserving existing jobs for East Boston residents.

Several businesses on the Boston side of the harbor hire employees residing in Boston for employment in bakery production, material cutting or stitching, warehouse or distribution activities, leather manufacturing, etc. The majority of these employees reside in South Boston, Dorchester or Roxbury. On the East Boston side of the harbor, several employees reside in East Boston while the majority reside in communities to the north. Excluding the Stop and Shop Bakery employees, which will be affected by that company's recently announced relocation plans, employment opportunities and job accessibility for all current employees should be maintained, resulting in no harm to current employees.

The relocation interviews conducted for this study indicate the number of minority-owned businesses relocated by the project is negligible. The percentage of minority employment at Logan Airport is lower than for the City of Boston as a whole. Business relocations at the Airport are not expected to affect a significant number of these employees. Minority representation in certain areas, however, is higher. In South Boston the number of minority employees affected by relocation is approximately 16 percent of the total affected work force. This percentage is comparable to the total number of employed minorities who reside in the City of Boston (18 percent).

5.0 MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS RELOCATION PROCEDURES

A business relocation agent will be assigned by the MDPW to assist

each relocating business in all phases of relocation and in the preparation of documentation required to process payment claims. The relocation agents will inform all business owners of their benefits and entitlements, courses of action which are open to them, any special provisions designed to encourage businesses to relocate within the city, and other public or private programs that may provide them with assistance.

5.1 Relocation Benefits

Depending on the type of ownership and the business options one chooses, displaced businesses are eligible for several payments:

1. Actual reasonable costs of moving and related expenses.

2. Direct loss of tangible personal property for items that are not moved and cannot be sold.

3. Actual reasonable expenses in searching for a replacement business, not to exceed $500.

4. A fixed payment in lieu of the payment for actual expenses and losses, not to exceed $10,000.

In addition, the property owners are reimbursed for the full fair market value of the business property. If any business or property owner has been denied a payment or disagrees with a computed amount, an administrative appeal process is available through the Hearing Examiner of the MDPW.

5.2 Functional Replacement

FHWA policies provide for functional replacement of publicly-owned facilities displaced by the project where replacement is in the public interest, as determined by consultation with FHWA. Functional replacement involves compensation beyond appraised market value of public property taken for highway projects if replacement cost exceeds appraised value. FHWA must approve actual replacement cost and review site selection design and construction. In the context of relocation, functional replacement may apply, for example, to the General Aviation Building at Logan Airport depending on the composition of its tenants at the time the building is acquired. The applicability of functional replacement will be pursued further during the design phase.

6.0 OTHER POSSIBLE SOURCES OF ASSISTANCE

Other potential resources to minimize economic harm to displaced business establishments and to increase the likelihood of their remaining within city limits were explored. Sources contacted include state and local agencies; the U.S. Small Business Administration (SBA); Economic Development and Industrial Corporation of Boston (EDIC/Boston); Neighborhood Development and Employment Agency (NDEA); the Massachusetts Government Land Bank; and local banks. In some cases, the SBA will guarantee loans or issue a debenture in conjunction with other lenders.

Several other agencies have programs which could assist relocating businesses. These include:

- NDEA of Boston operates a program for retail and commercial businesses in nine targeted sections of Boston. For eligible businesses, the program provides loans at reduced interest rates for facade improvements or commercial development through participating commercial banks. This program also provides loan packaging and architectural assistance.

- EDIC/Boston assists in reviewing the financial needs of businesses, provides direct loan packaging assistance or referral to other financial assistance programs, and

maintains listings on available industrial sites including parks developed by EDIC, and information on Boston's labor force.

- Massachusetts Government Land Bank can sell or rent space to businesses at below market interest rates. It may work directly with businesses or through EDIC/Boston.

In order to minimize inconveniences and impacts to businesses displaced by the project, the Commonwealth of Massachusetts will provide assistance to affected businesses in attempting to secure additional funds.

Table 1

INFORMATION SOUGHT AT RELOCATION INTERVIEWS

1. Type of business.

2. Tenure.

   a. Number of years at present location.

   b. Own/rent.

   c. Plans on moving or remaining in place.

3. Gross floor area and square footage by use of space.

4. Information on employees.

   a. Number of employees.

   b. Number from local neighborhood.

   c. General residential information of other employees.

   d. Number of people driving or taking public transportation to work.

5. Work hours and shifts.

6. Origin of customers: whether or not customers come to the site or have deliveries made to them.

7. Preferred relocation area and necessity of being located next to certain businesses.

8. Rent and mortgage payments per month, including taxes and utilities.

9. Expansion or diversification plans.

10. Amount of lead time needed for relocation.

11. Special business requirements.

Table 2

RELOCATION REQUIREMENTS[1]

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
1	Anelex Property 150 Causeway St., Boston	Primarily office, some storage, over 62 tenants	2200	rent	504,000	45,492
1A	440-car parking lot	open air lot		rent		
2	Charles River Building 131 Beverly St., Boston	Primarily Mf & Whsg (2 floors vacant)				
	Wynco Distributors	Tile Distributors	15	rent	17,000	
	Laurelite Mf	Lighting Fixtures Mf & Distr	55	rent	15,000	
	Blauer Mf & Distr	Coat Mf	15	rent	10,000	
	MGH Office	Record Storage	1	rent	10,000	
	Copley Business Service	Mailing Service	100	rent	35,000	
	Addison Getchell Company	Printers	25	rent	10,000	
	Machine Composition Company	Typesetters	25	rent	10,000	
	Department of Mental Health	Office	25	rent	5,000	
3	Stop and Shop Bakery[4] 226 Causeway St., Boston	Bakery Mf & Distr	300	own	200,000	
	Parcels, under Central Artery[5]	Parking	30			
4	Beverly St. Lot			rent	-	
5	Haverhill St. Lot (1 of 2 parcels)			rent	-	
6	Causeway St. Lot			rent	23,900	
7	N. Washington St. Lot			rent	38,500	

Table 2

RELOCATION REQUIREMENTS[1]

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
8	Cooper St./Stillman Pl. Lot (Tecce's Lot)			rent		6,400
9	Endicott/Stillman St. Lot (Castignetti's Lot)			rent		525
10	N. Washington/Cross/New Chardon St. Lots (2)			rent		24,500
11	Blackstone/North/Cross St. Lot			rent		84,800
12	Purchase/High/Atlantic St. Lots (2)			rent		19,800
13	Hook Lobster 15 Northern Avenue	Retail/Wholesaling mainly lobsters	16	own	5,000	
14	Rapid Service Press Building 375 Broadway, Boston	Mf/whsg				
	Rapid Service Press	Printing	60	rent	40,000	
	Snyder Leather	Leather goods warehouse	15	rent	30,000	
15	Solomon Parking 275 A St., S. Boston	Open Air Parking	2	own		38,000

Table 2

RELOCATION REQUIREMENTS[1] (Cont'd)

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
16	Slade Gorton Company 295 A St., S. Boston	Wholesale Frozen Fish Distributors	65	own	50,000	
17	Boston Plate & Window Glass 40 Wormwood St., S. Boston	Glass & Metal Fabricator	15	own	45,000	
	Tenant	Mf Wood Skids	2	rent	5,000	
18	Noymer Manufacturing Company 430 Summer Street, S. Boston	Manufacturer and importer of leather goods	75	own	30,000 sf	2-1/2 acre lot
19	Harding Company 335 B St. Extension	Supply & Mf of Hoisting & Rigging Equipment	16	own	21,000	
20	Pappas Building 440-450 Summer Street, S. Boston	Office, manufacturing, and warehouse space				
	Color Film Corporation	Film and video duplication	7	rent	--	
	PPG Industries	Wholesale glass retailers	16	rent	23,000	
	Wardrobe Maker	Clothing manufacturer	80	rent	50,000	

Table 2

RELOCATION REQUIREMENTS[1] (Cont'd)

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
	Massachusetts General	Warehousing	6	rent	25,000	
	Pappas Enterprises	Administrative center for company owned businesses	25	own	19,000	
	Spencer Shoes	Administrative center and distributing point for shoe business	109	rent	115,000	
	Provoust - Lefebvre	Wool products retailers	4+	rent	1,200	
21	Commercial Union Insurance Companies 30 Trilling Way, S. Boston	Provides shipping, warehousing, printing services for Boston area offices	67	rent	120,000	
22	Eastern Reservation Building Logan Airport	Reservations for all of New England and upstate NY	430	rent	49,000	
	Continental Airways	Sales office	4	rent	1,000	
23	General Aviation Building[6]	Primarily office space			25,580	
	FAA Office	Airway facilities personnel	21	rent	3,200	
	Aerial Photos International	Storage	0	rent	1,000	
	National Weather Service	Provides weather service	35	rent	4,766	
	Linda's Incorporated	Cafeteria	3	rent	300	

Table 2

RELOCATION REQUIREMENTS[1] (Cont'd)

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
24	Hill Air Cargo Building	Freight Forwarding				
	Air Canada	Freight Forwarder	12	rent	7,300	
	Kintetsu World Express	Freight Forwarder	17	rent	8,800	
	Nippon Air Express	Freight Forwarder	20	rent	10,500	
	Piedmont	Freight Forwarder	8	rent	3,300	
	Behring International	Freight Forwarder	7	rent	800	
	Providence Air Charter	Freight Forwarder	7	rent	4,400	
	Northern Air Freight	Freight Forwarder	3	rent	630	
	Redford Hill	Freight Forwarder	5	rent	3,000	
	Panalpina Airfreight	Freight Forwarder	3	rent	700	
	Brian A. Hill, Custom House Broker	Freight Forwarder	3	rent	1,100	
	Kuehne & Nagel	Freight Forwarder	14	rent	3,000	
	U. S. Air	Freight Forwarder	13	rent	1,400	
25	Eastern Air Freight Building Logan Airport	Freight Forwarding				
	Eastern Air Freight	Freight Forwarder	44	rent	30,000	
	Air Express International	Freight Forwarder	25	rent	9,000	
	Bar Harbor	Freight Forwarder	3	rent	450	

Table 2

RELOCATION REQUIREMENTS[1] (Cont'd)

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
26	National Car Rental Logan Airport	Car rental	120	rent	9,400	140,000
27	Hertz Rent-A-Car (partial) Logan Airport	Express rental	15	rent		41,000
28	Exxon Service Station Logan Airport	Service Station	14	rent	1,950	38,300
29	Central Air Freight Terminal Logan Airport	Freight forwarding				
	ABC Air Freight	Freight forwarding	11	rent	4,050	
	Airport Express Freight	Freight forwarding	6	rent	950	
	D & J Motor Company	Freight forwarding	22	rent	4,000	
	Morrison Express International	Freight forwarding	7	rent	912	
	APE International	Freight forwarding	9	rent	1,000	
	Allied Air Freight	Freight forwarding	4	rent	800	
	Direct Courier	Freight forwarding	1	rent	200	

Table 2

RELOCATION REQUIREMENTS[1] (Cont'd)

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
30	United Air Flight Kitchen Logan Airport	Catering	70	rent	12,000	
31	Robie Airport Park[7] (partial taking) 161 Prescott St., E. Boston					
	Federal Express	Freight Forwarding	32	rent	19,700	
	Avis Car Maintenance		42	rent	35,700	5,560

Table 2 (Continued)

1. Findings are based on information provided by owner or tenant when available.

2. See Figures 1 through 4.

3. Lot areas are listed when the parcel area constitutes a critical business element, such as a parking lot.

4. The building is not taken but the loading docks would be; the Bakery has recently announced plans to relocate independent of the project.

5. Approximately 30 people are employed at these parcels on a full-time basis. Other employees work here on a seasonal or part time basis ranging from a few hours per week and up.

6. Three tenants -- Butler Aviation, Van Dusen, Direct Courier -- will relocate to Bird Island Flats in the near future. Another tenant, Massachusetts Aeronautics Commission, will relocate to the new State Transportation Building upon its completion although they may retain a small space at the General Aviation Building. Massport plans to take 1000 sf of the building to make way for a service road to Bird Island Flats. Remaining space will most likely be made available for general office uses.

7. A 6000 sf annex will also be taken. The building is currently vacant but the owner plans to rent space to an airport-related tenant such as a customs house broker.

Table 3

EXAMPLES OF AVAILABLE COMMERCIAL SPACE

Location	Area (sf)	Type of Space	Sale/Lease
Kneeland Street	75,000	Office	Lease
Washington Street	75,000	Office	Lease
Atlantic Avenue	35,000	Office	Lease
N. Washington Street	50,000	Office	Lease
Congress Street	32,000	Office	Lease
Congress Street	50,000	Office	Lease
Milk Street	70,000	Office	Lease
Liberty Square	41,000	Office	Lease
Devonshire Place	138,000	Office	Lease
Buildings in various stages of Construction or about to be constructed			
Dewey Square	1,125,000	Office	Lease
Federal Street	175,000	Office	Lease
State Street	845,000	Office	Lease
Franklin Street	287,000	Office	Lease
State Street	385,000	Office	Lease
Westborough			
Flanders Road	34 acres	Parcel	Sale
Southborough			
Rte. 9/Deerfield Road	16 acres	Parcel	Sale
Marlborough			
Rtes. 495/290	140 acres	Parcel	Sale
Boston			
Melnea Cass Boulevard	7-1/2 acres	Parcel	Lease with option to buy
A Street	50,000	Manufacturing	Lease
Wormwood Street	3 buildings	Manufacturing	Lease
Summer Street	90,000	Manufacturing	Lease
Summer Street	25,000	Manufacturing	Lease
D Street	150,000	Manufacturing	Lease
Summer Street	1,651,000	Manufacturing	Lease
Stillings Street	26,400	Manufacturing	Sale/ Lease
Summer Street	16,000	Manufacturing	Sale/ Lease
Summer Street	18,750	Manufacturing	Sale/ Lease
Summer Street	5 acres	Office/Manu- facturing	Sale/ Lease

APPENDIX 3:
TRAFFIC

APPENDIX 3:
TRAFFIC

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APPENDIX 3
TRAFFIC

1.0 TRAFFIC DATA COLLECTION, FORECASTING PROCEDURE, AND METHODOLOGY

1.1 Traffic Data Collection

Since this study involved design refinements to a previously studied Alternative 5A, no additional traffic data collection was required. All types of traffic counts as well as traffic speeds and roadway inventories were available from a variety of sources including the Massachusetts Department of Public Works, the Massachusetts Turnpike Authority, the Massachusetts Port Authority, the Metropolitan District Commission, the Central Transportation Planning Staff, the Boston Traffic and Parking Department, the Boston Redevelopment Authority, as well as previous data collections for this project. Appendix 4 of both the DEIS/DEIR and SDEIS/SDEIR discuss the data collection process in detail.

1.2 Traffic Forecasting Procedure

The traffic forecasting procedure used by the Central Transportation Planning Staff (CTPS) for this study was identical to the procedure used for the previous Third Harbor Tunnel/Depressed Central Artery analyses. For this project, however, certain links and ramps within the Alternative 5A computerized network were revised to show the viable design refinements needed at those traffic "trouble spots". For a complete understanding of the forecasting involved, Appendix 4 of both the DEIS/DEIR and the SDEIS/SDEIR describe the procedure in detail.

1.3 Traffic Analysis Methodology

The traffic analysis methods as described in Appendix 4 of both the DEIS/DEIR and SDEIS/SDEIR were employed for the Preferred Alternative, to permit equal comparisons amongst alternatives.

1.4 Additional Information

As requested by the Executive Office of Environmental Affairs (EOEA), additional tables, figures and sample calculations have been included in this Appendix.

Existing Traffic Flow Charts (Figures 1, 2 and 3) for AM peak hour, PM peak hour, and daily traffic along the Central Artery and the Southeast Expressway within the area studied have been prepared for this Appendix. The existing volumes are the actual counted volumes which were used for comparison with the No-Build and all build alternatives.

Table 1 depicts the theoretical hourly capacities on major links and ramps within the area studied. These computed capacities were based on many design factors including:

- number of travel lanes,
- lane width,
- distance from the edge of the travel way to the nearest obstruction (side clearance),
- vertical and horizontal alignment, and
- composition (percentage) of trucks.

Also provided in this Appendix are sample calculations for determining levels of service at Leverett Circle, Bell Circle, and critical locations on the Southeast Expressway (Exhibits A-D).

For detailed traffic analysis results of the Preferred Alternative, see Section 4.2 of the FEIS/FEIR.

2.0 BASE CASE AND FUTURE PREDICTED QUEUES AND DELAYS ON EXPRESS HIGHWAY FACILITIES

2.1 Method

The procedures utilized in estimating queue lengths and vehicle

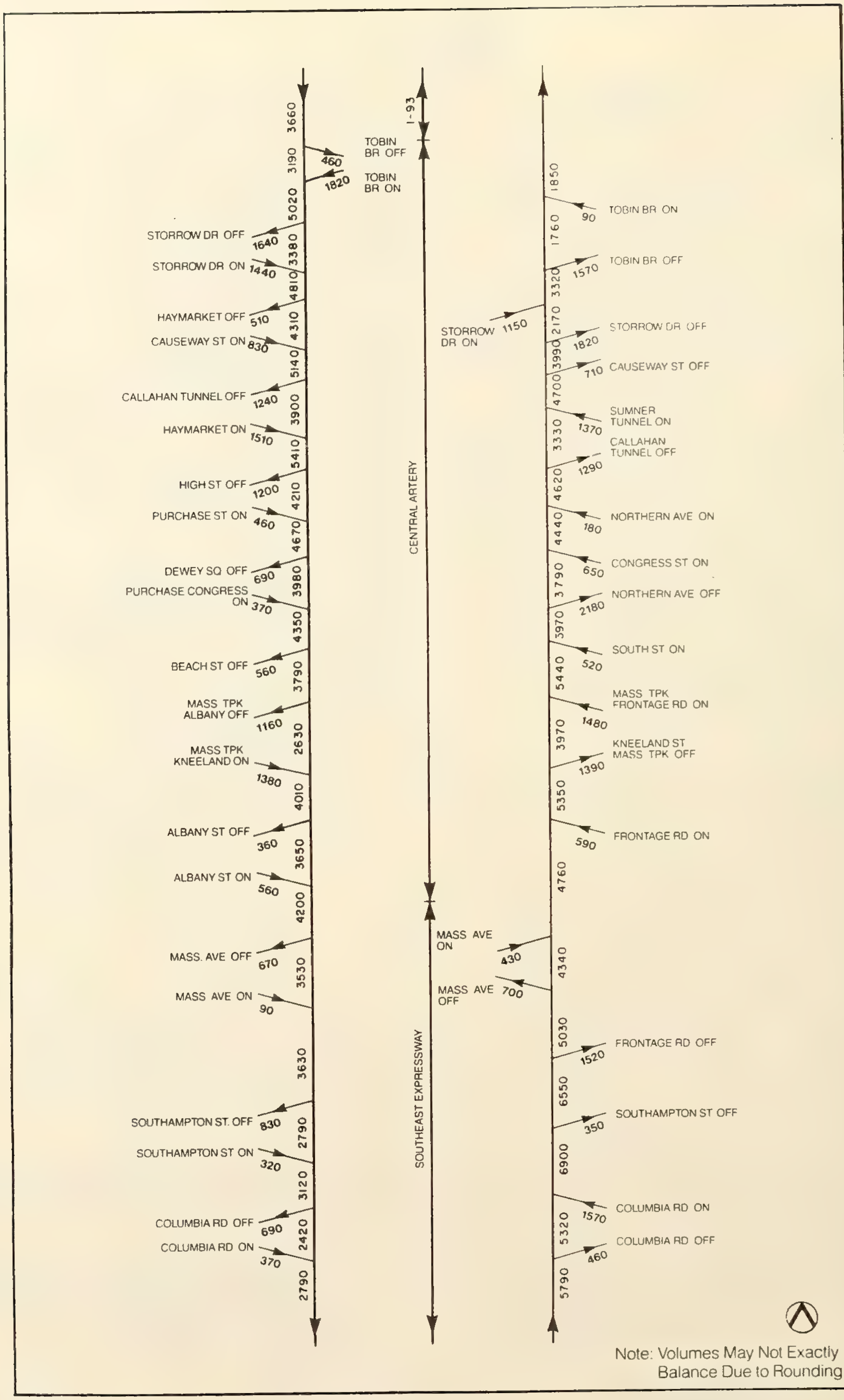


Figure 1

1982 Existing Network Traffic Flow Chart
A.M. Peak Hour

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

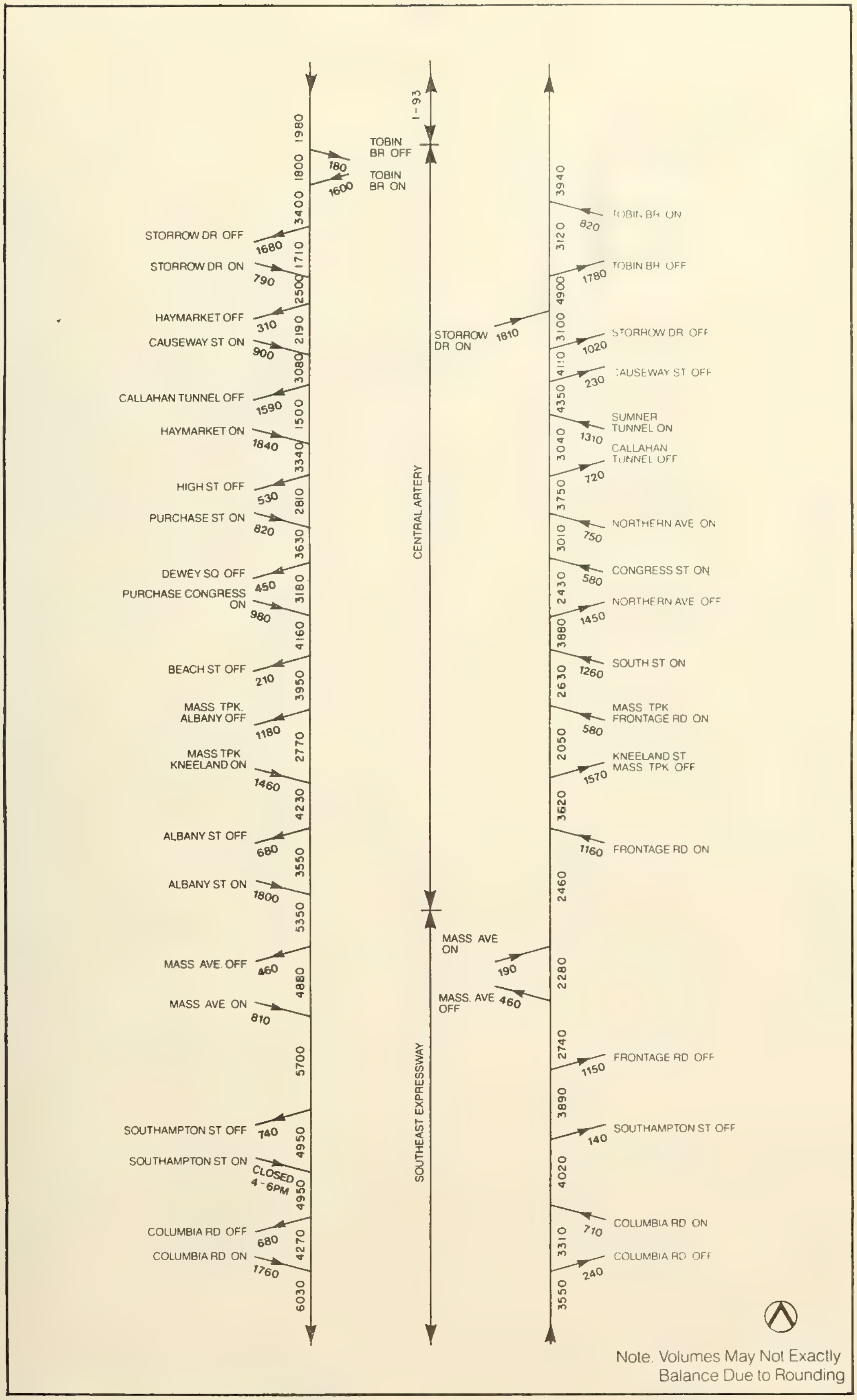


Figure 2

1982 Existing Network Traffic Flow Chart
P.M. Peak Hour

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

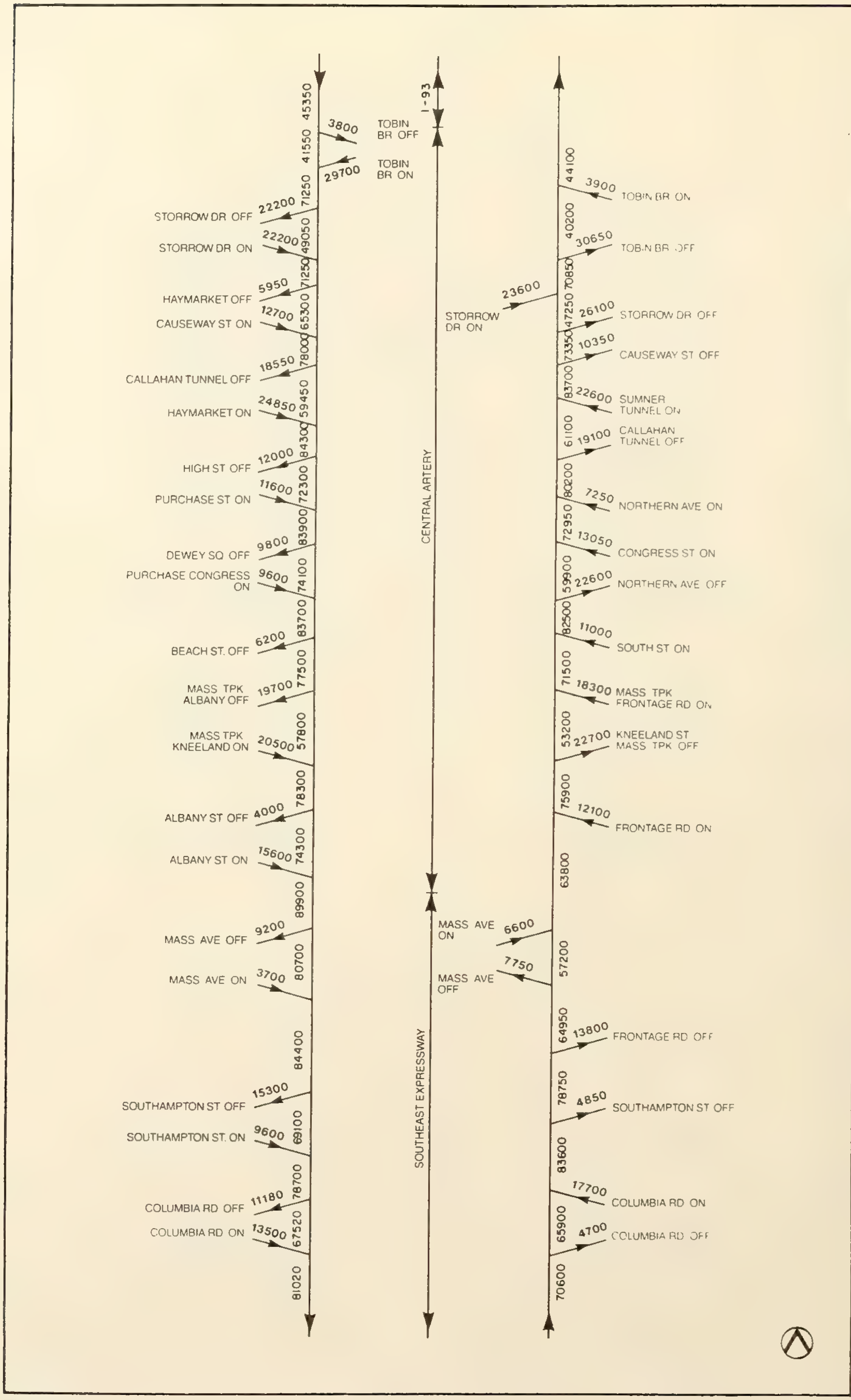


Figure 3

1982 Existing Network Traffic Flow Chart
Average Weekday Daily Traffic

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Table 1

CAPACITIES OF SELECTED HIGHWAY LINKS AND RAMPS

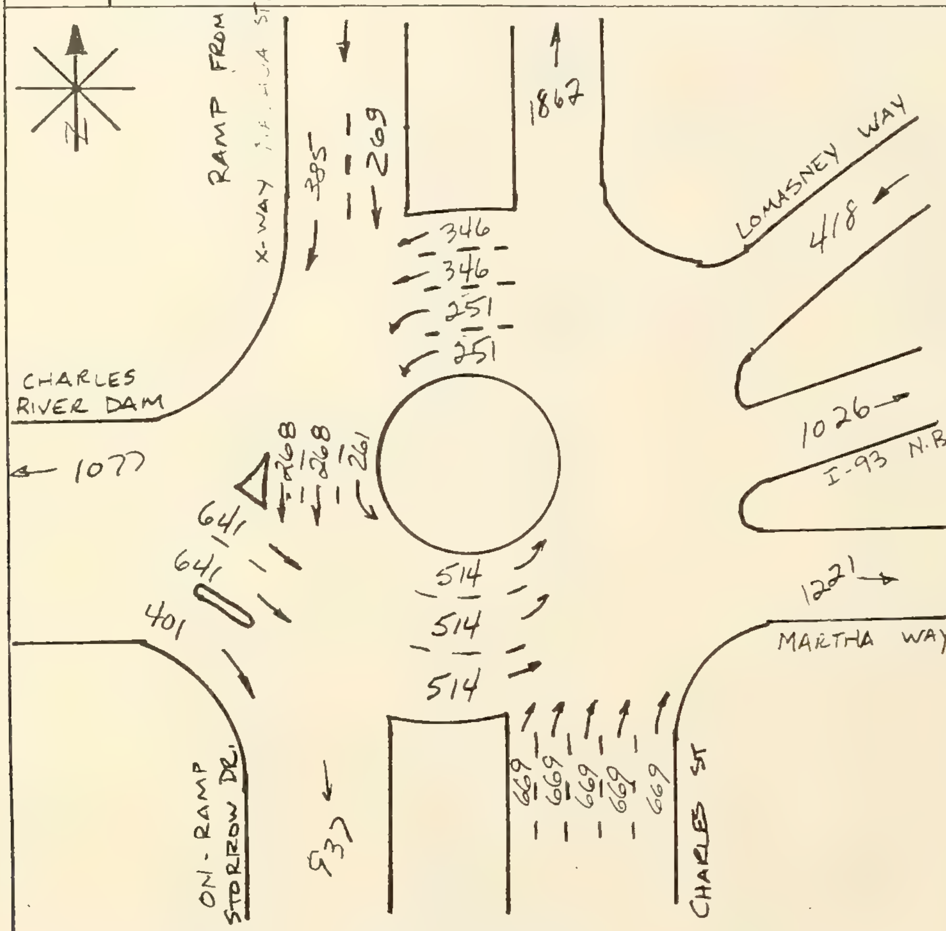
LOCATION	HOURLY CAPACITY (VPH)	
	No-Build	Pref. Alt.
Northbound Links		
S. E. Expressway between Columbia Rd. & Southampton St.	7200	7200
S.E. Expressway between Mass. Ave. & Mass. Pike		7200
7200		
Central Artery in the Dewey Sq. Tunnel (Fort Point Channel Tunnel for Alt. 5A Modified)	5400	7000
Central Artery between Atlantic Ave. & Sumner/Callahan Tunnels	5250	9800
Central Artery between Sumner/Callahan Tunnels & Storrow Dr.	6350	8600
Central Artery between Storrow Dr. & Mystic-Tobin Br.	5250	8350
Mystic-Tobin Bridge	5350	5350
I-93 north of Charlestown	7200	7200
Callahan Tunnel	2900	2900
Third Harbor Tunnel	NA	3400
Rte. 1A between Airport & Neptune Rd.	5650	6450
Southbound Links		
S.E. Expressway between Southampton St. & Columbia Rd.	7200	7200
S.E. Expressway between Albany St. & Mass. Ave.	8300	9450
Central Artery in the Dewey Sq. Tunnel	5400	10950
Central Artery between Sumner/Callahan Tunnels & Congress St.	5400	8950
Central Artery between Storrow Dr. & Sumner/ Callahan Tunnels	5400	8950
Central Artery between Mystic-Tobin Br. & Storrow Dr.	5150	9300
Mystic-Tobin Bridge	5350	5350
I-93 north of Charlestown	5400	7300
Sumner Tunnel	2700	2700
Third Harbor Tunnel	NA	3400
Rte. 1A between Neptune Rd. & Airport	5650	7500
Northbound Ramps		
Atlantic Ave. to Central Artery (NB)	1500	2800
Central Artery (NB) to Callahan Tunnel (Surface Artery for Alt. 5A Mod.)	1550	2800
Sumner Tunnel to Central Artery (NB)	1550	1350
Airport to Rte. 1A (NB)	1600	2550
Southbound Ramps		
S.E. Expressway (SB) to Mass. Ave.	3160	3160
Central Artery (SB) to Callahan Tunnel	3000	1350
Central Artery (SB) to Storrow Dr.	1500	2800
Rte. 1A (SB) to Airport	1600	3650

H-F-M-W

A Joint Ventu

INTERSECTION: LEVERETT CIRCLE						
ALT:	YEAR: 2010	AM PEAK HR	BY: RMB	DATE:	CHK: L.V.	DATE

GEOMETRY - LANE VOL'S - TURNING MOVES	LEFT TURN CHECK



APPRO

1 2 3

a) No. of change Intervals per hr.

b) Left turn Cap. on change interval (vph.)

c) G/C Ratio

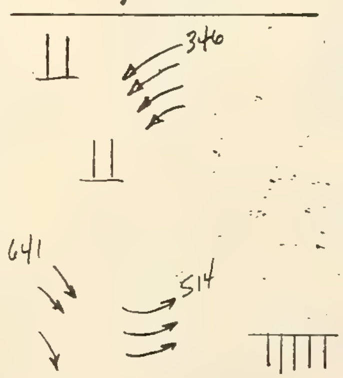
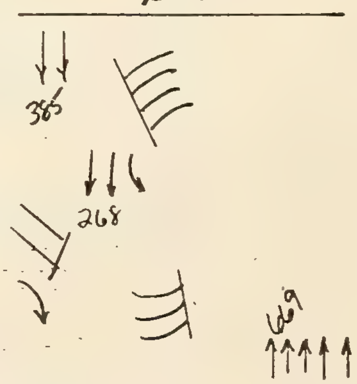
d) Opposing Vol. (vph)

e) Left turn Cap. on green (vph)

f) Left turn Cap. (b & e)

g) Left turn Vol. (vph)

h) Is Vol > Cap?

ØA	ØB	ØC	ØD
			
ΣCLV: 641	ΣCLV: 669	ΣCLV:	ΣCLV:

ΣCLV: 1310	LOS: D	COMMENTS:

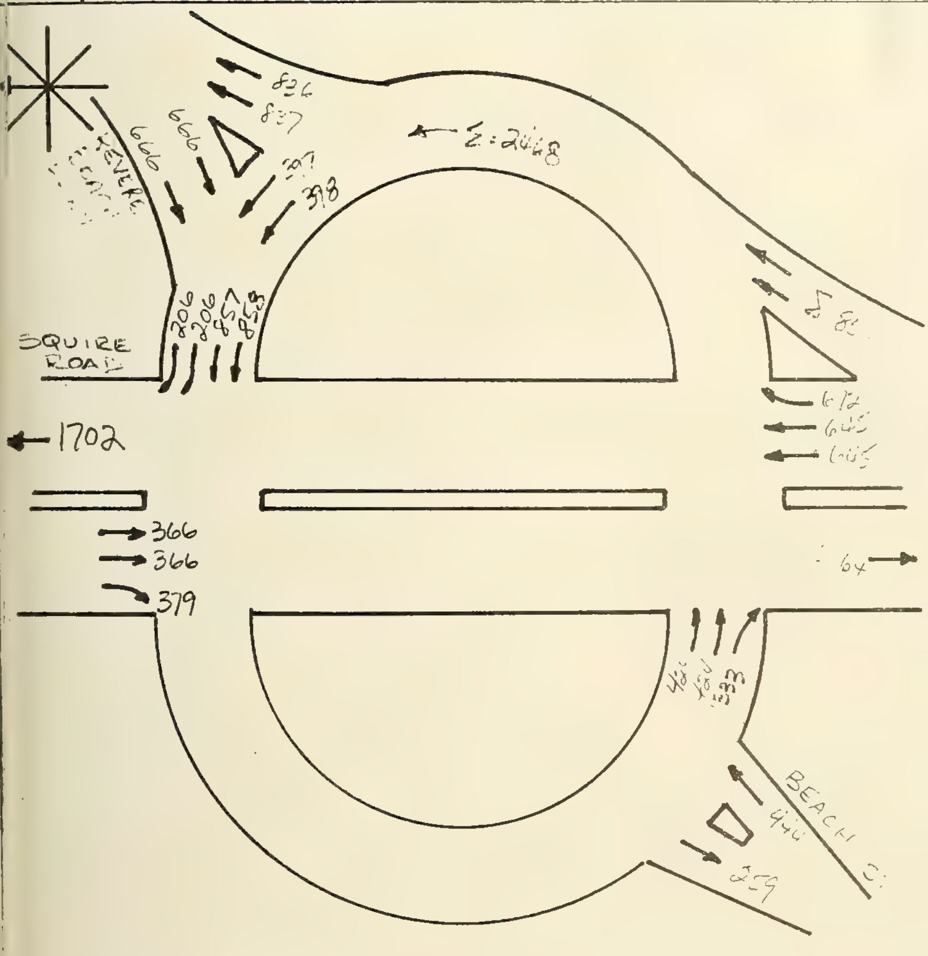
EXHIBI

F-M-W. A Joint Venture.

INTERSECTION: [illegible] CIRCLE

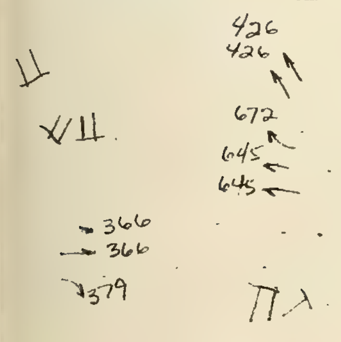
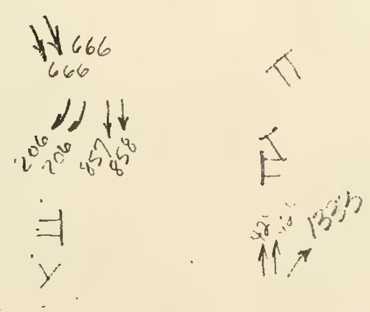
ALT: 5A. [illegible]	YEAR: [illegible]	PM PEAK HR	BY: [illegible]	DATE:	CHK: L.V.	DATE:

GEOMETRY - LANE VOLS - TURNING MOVES



LEFT TURN CHECK

	APPROACH 1	2	3	4
a) No. of change Intervals per hr.				
b) Left turn Cap. on change interval (vph.)				
c) G/C Ratio				
d) Opposing Vol. (vph)				
e) Left turn Cap. on green (vph)				
f) Left turn Cap. (b + e)				
g) Left turn Vol. (vph)				
h) Is Vol > Cap?				

ØA	ØB	ØC	ØD
			
ΣCLV: 672	ΣCLV: 1333	ΣCLV:	ΣCLV:

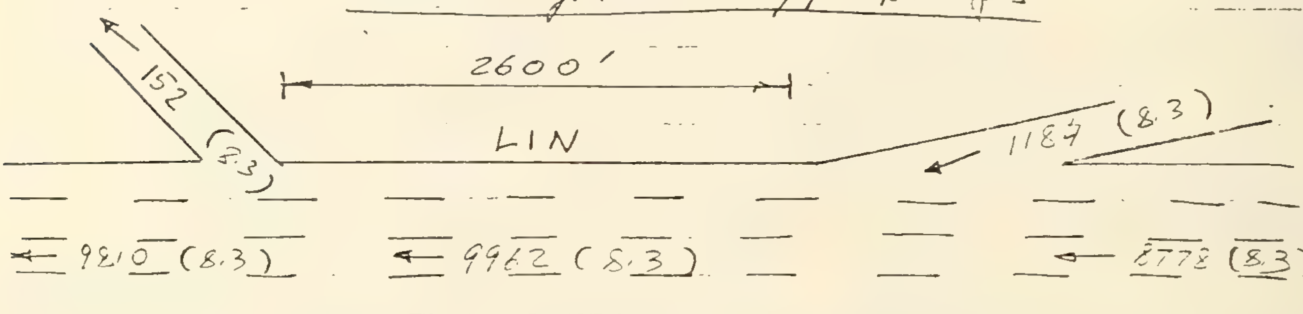
ΣCLV: 2005 | LOS: F

COMMENTS:

EXHIBIT B

PROJECT IHT / DEPRESSED C.A. ACC. NO.
SUBJECT Alternative 5A.5 LIN SHEET NO. 1 OF 2
YEAR 1990 AM PEAK HOUR DATE July 19 83
COMP. L.V. CHECK CONT. NO.

S.E. X-way NB between Columbia On - and
Southampton Off - Ramps



Merge Area

$V_1 = -353 + 0.199 \times 8778 - 0.057 \times 1184 + 0.486 \times 152 = 1400$ vph

Lane 1 trucks: $8778 \times 0.083 \times 0.82 = 597$

$V_{merge} = (1400 + 597 + 1184 \times 1.083) / 0.97 = 3381$ pcph

Table 4.1 $\boxed{\text{LOS F}}$

Diverge Area

Assume all of the on-ramp traffic stays in lane one due to LOS F at merge

On-ramp traffic exiting at off-ramp: 18vph (straight proportion)

$V_{Diverge} = (1184 + 152 - 18) \times 1.083 / 0.97 = 1472$ pcph

Table 4.1 $\boxed{\text{LOS C}}$

EXHIBIT C

PROJECT ______ ACC. NO. ______
SUBJECT 5A.5 L1N SHEET NO. 2 OF 2
1990 AM DATE ______ 19__
COMP. LV CHECK ______ CONT. NO. ______

L1N – main line

$V = 9962 \times 1.083 / 0.97 = 11123$ pcph

Table 2.8 (AHS -50) $\boxed{\text{LOS F}}$

main line downstream

$V = 9810 \times 1.083 / 0.97 = 10953$ pcph

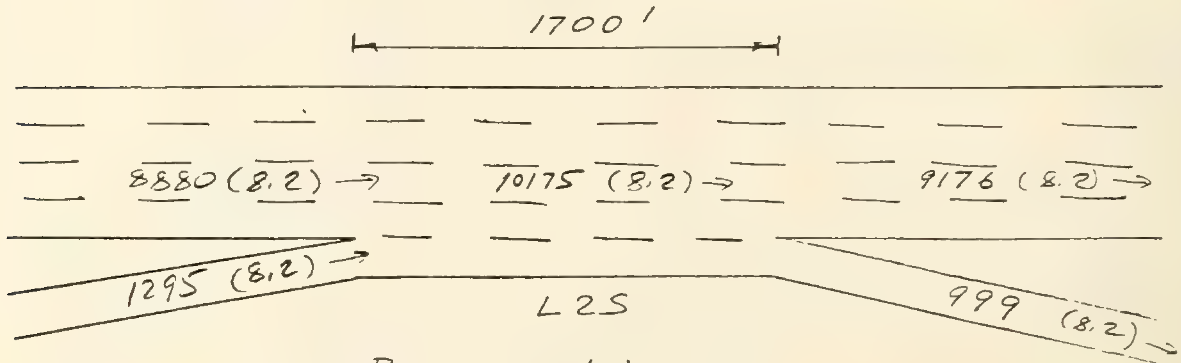
Table 2.8 $\boxed{\text{LOS F}}$

EXHIBIT C (Continued)

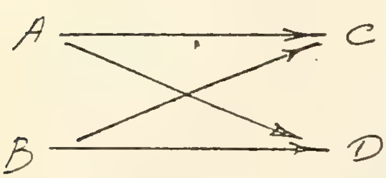
PROJECT: CA/T / DEPRESSED C.A.		ACC. NO.
SUBJECT: Alternative 5A.5 L2S		SHEET NO. 1 OF 2
YEAR 2010 PM PEAK HOUR		DATE July 1983
COMP. L.V.	CHECK	CONT. NO.

THE MAGUIRE GROUP

S.E. X-Way between Mass. Ave. and Southampton St.



Ramp WEAVE



Use straight proportion to determine weaving volumes

$A = \frac{8880 \times 1.082}{0.97} = 9905$ pcph

$B = \frac{1295 \times 1.082}{0.97} = 1445$ pcph

$C = \frac{9176 \times 1.082}{0.97} = 10235$ pcph

$D = \frac{999 \times 1.082}{0.97} = 1114$ pcph

$V_{w_1} = 1303$ pcph

$V_{w_2} = 972$ pcph

$V_{NW_1} = 8932$ pcph

$V_{NW_2} = 142$ pcph

$V_w = 2275$ pcph

$V_{NW} = 9074$ pcph

$V = 11350$ pcph

1) $S_{NW} = 30$ MPH; $S_w = 36$ MPH; $\Delta S = -6$ VR = 0.20; R =

$N_w(max) = 2.0$; $N_w/N = 0.35$

$N_w = 1.77 < N_w(max)$ - unconstrained

$N_{NW} = 3.23$; $S_{NW} = -46$ MPH

$\boxed{LOS_{NW}\ F}$ $\boxed{LOS_w F}$

EXHIBIT

PROJECT		ACC. NO.	
SUBJECT	5A.5 L2S	SHEET NO. 2 OF 2	
	2010 PM	DATE	19
COMP.	LV	CHECK	CONT. NO.

Main Line

V= 11350 pcph

Table 2.8 (AHS = 50) $\boxed{\text{LOS F}}$

Main Line downstream

V= 10235 pcph

Table 2.8 (AHS = 50) $\boxed{\text{LOS F}}$

EXHIBIT D (Continued)

delays on the express highway facilities of the affected roadway network are those documented in CTPS Technical Report #36 - A Procedure for Predicting Queues and Delays on Expressways in Urban Core Areas - February, 1983. The procedure is based on relationships between hourly traffic carrying capacities of the highways at bottleneck points, Average Weekday Daily Traffic (AWDT) volumes at those points, and associated peak-period queues and delays. The procedure was developed by comparing observed bottleneck capacities (derived from traffic counts) with empirical delay data for traffic upstream of the bottlenecks. The delay data were obtained from nearly 600 speed runs performed on express highways in and near downtown Boston.

The basic relationship between average maximum peak period delays and AWDT, related to hourly capacities at bottlenecks, are illustrated in Figure 4 and Figure 5, respectively, for the AM and PM peak periods. As can be seen in the figures, peak-period queues and delays begin to develop when AWDT volumes reach or exceed eight to ten times the hourly capacity at the bottleneck point. As can also be seen from the figures, PM delays are greater than AM delays for given AWDT/capacity relationships because PM traffic is heavier than AM traffic.

In order to calculate queue lengths from the delay curves shown in Figures 4 and 5, a comparison must be made of queue speed on the same segment under uncongested flow. The difference between queue speed and uncongested speed implies a delay per unit distance. With this value determined, as well as the total delay in the queue (obtained from Figure 4 or Figure 5), a queue length can be determined by calculating the distance of travel necessary to accumulate the total delay.

Figure 6 illustrates the relationship between queue speed and conventional hourly volume-to-capacity ratios and shows what is, in effect, a Level-of-Service "F" curve for queues. Figure 6 also shows the Level-of-Service "F" curve from the Highway Capacity Manual. This is the curve that applies when there is no explicit bottleneck, and traffic operates in a stop-and-go fashion with only intermittent queuing. From these curves, one can see that not all queues move at the same speed. Thus, a slow-moving queue may accumulate quite a lot of delay in a very short distance, while a fast-moving queue might be quite long, but only involve a modest amount of delay.

Before the procedure for predicting queue lengths and delays can be undertaken, the bottlenecks must be identified. These typically are the points in the express highway network that have the highest daily volumes relative to capacities. In addition, where multiple queuing situations affect one another, special procedures apply. These are discussed in CTPS Technical Report #36.

There are two qualifications that must be understood as related to the application of the CTPS queuing model to the Central Artery/Third Harbor Tunnel FEIS/FEIR. The first is that the basic procedure applies only to mainline queues and delays. Delays caused by congestion at ramps (other than expressway-to-expressway ramps) are not covered. The second is that the procedure is applied here only to bottleneck points within the study area boundaries. Bottleneck points outside of the study area--such as on the Southeast Expressway--are not considered even though their resultant congestion might extend into the study area.

2.2 Application

For the FEIS/FEIR, CTPS has performed queue and delay analysis for the Base Case (1977) and for seven alternatives for the year 1990. The seven alternatives include the No-Build Alternative (Alternative 1) plus Alternatives 3, 5, 6, 3A, the Preferred Alternative and the Two-Lane Tunnel Concept. These alternatives are, respectively, two four-lane Third

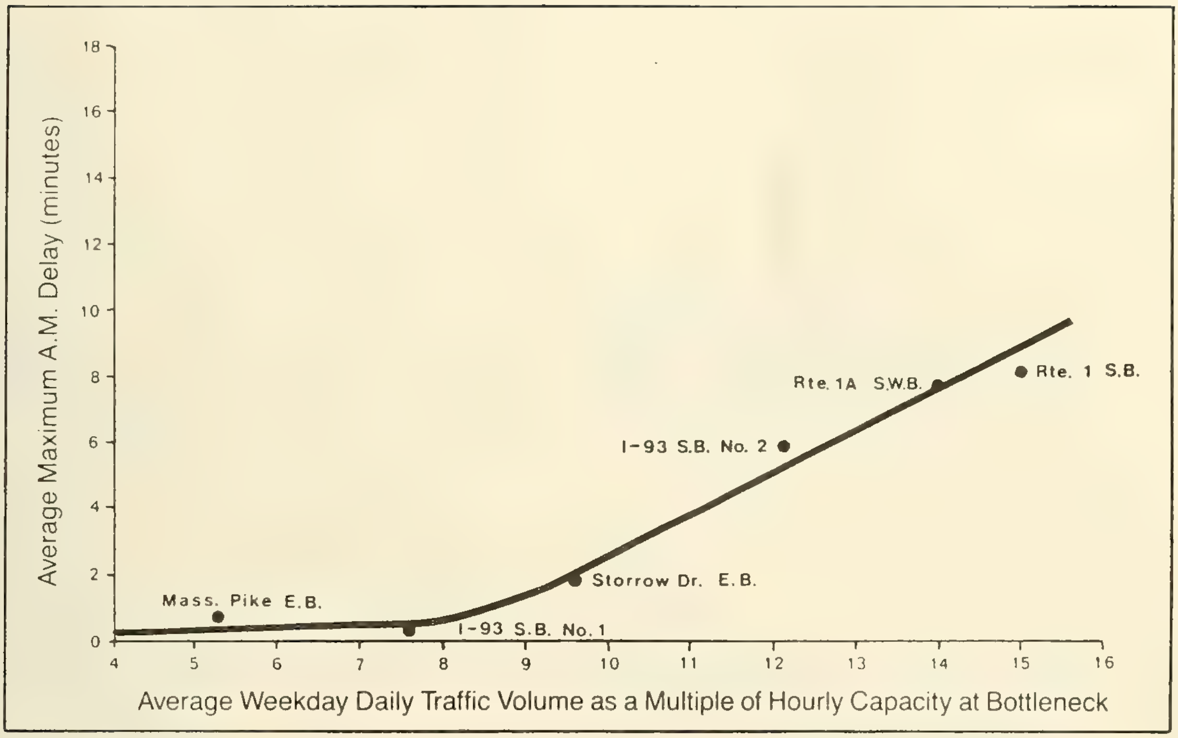


Figure 4

Daily Traffic Volume as a Multiple of Hourly Capacity at Bottleneck vs. Average Maximum A.M. Peak Delay

Source: CTPS Technical Report 36
EIS/EIR for I-90 - Third Harbor Tunnel; I-93 – Central Artery

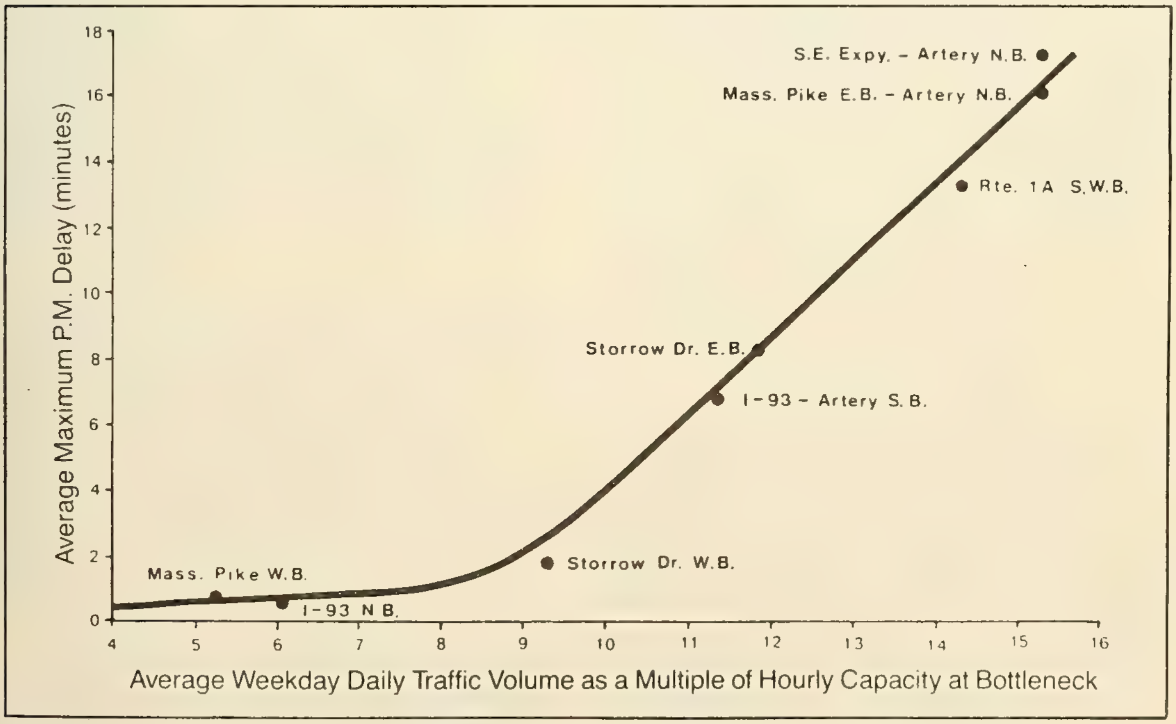


Figure 5

Daily Traffic Volume as a Multiple of Hourly Capacity at Bottleneck vs. Average Maximum P.M. Peak Delay

Source: CTPS Technical Report 36
EIS/EIR for I-90 -- Third Harbor Tunnel; I-93 – Central

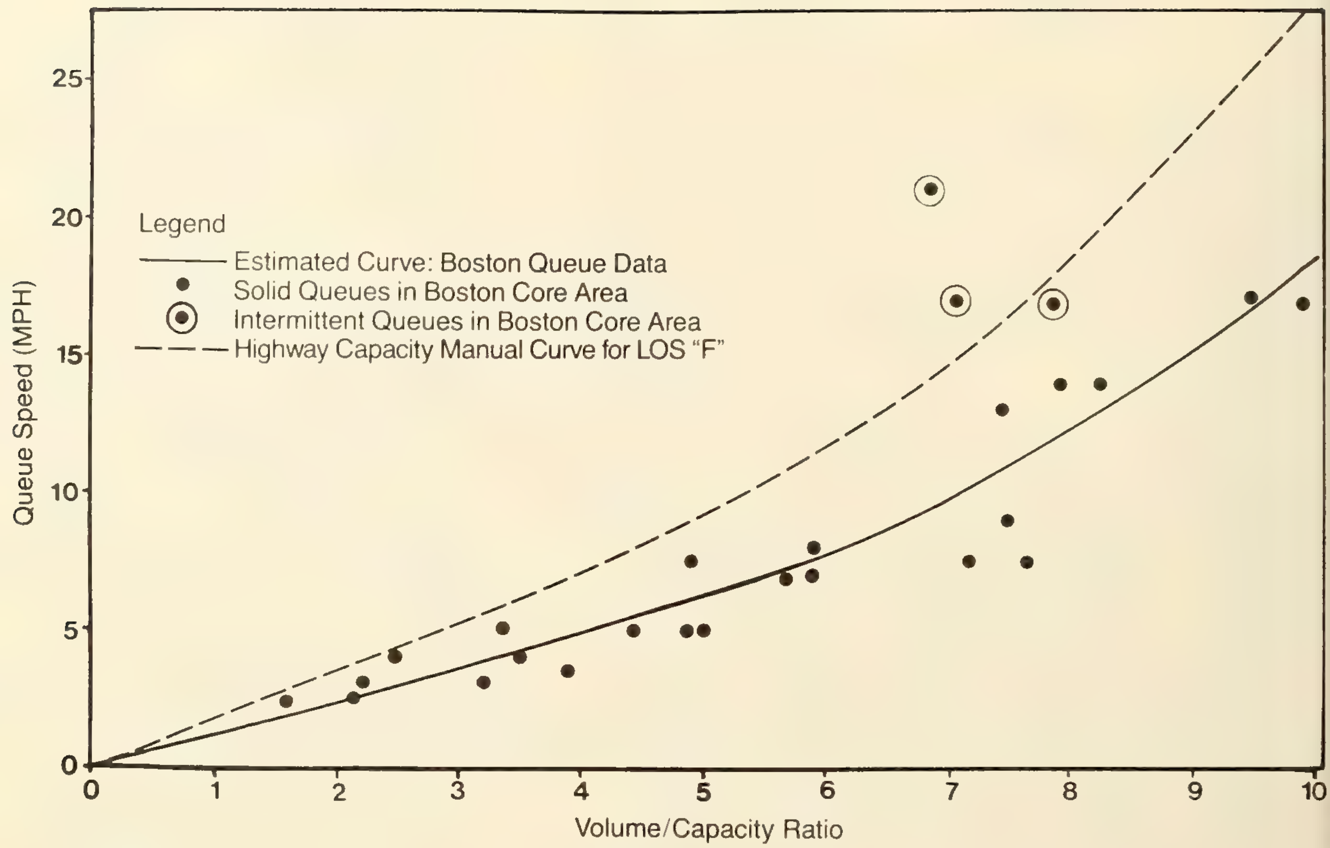


Figure 6

Relationship Between Hourly V/C Ratio and Queue Speed: A.M. and P.M. Queues

Source: CTPS Technical Report 36
EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Harbor Tunnel alternatives, an Artery Depression and Widening alternative, two alternatives with both Artery Depression and a four-lane Third Harbor Tunnel, and finally an alternative with Artery Depression plus a two-lane Third Harbor Tunnel.

2.3 Base Case - Daily V/C, Queues and Delays (1977)

Figure 7 shows 1977 volumes compared with daily practical capacities for the expressway system in and near downtown Boston. In this figure, daily practical capacity is considered to be ten times hourly capacity. As can be seen in the figure, most of the expressway system outside of the immediate downtown area has daily volumes that are less than practical capacity. The major exception outside of the downtown area is the Southeast Expressway, which has sections operating at 1.25 to 1.50 times practical capacity. Within the downtown area, however, most of the system is above practical capacity. The Sumner and Callahan tunnels in 1977 were operating between practical capacity and 1.25 times practical capacity, and the majority of the Central Artery was operating at more than 1.25 times practical capacity. In two sections, the Central Artery Bridge and the section of the Artery between the Callahan/Sumner Tunnels and Storrow Drive, daily volumes were in excess of 1.5 times practical capacity.

The sections of the expressway system with very high daily volumes relative to practical capacities create substantial bottlenecks with resulting peak period queues and delays on the system. These may be seen for the 1977 Base Case in Figures 8 and 9, respectively, for the AM and PM peaks.

During the AM peak, the greatest queues and delays are caused by the bottleneck point of the Central Artery Bridge over the Charles River, where southbound I-93 traffic merges with traffic from the Mystic-Tobin Bridge. The bottleneck at the merge of these two facilities generates solid queues on each roadway, which in 1977 extended approximately to Sullivan Square on I-93 and nearly to the toll plaza on the Mystic Bridge. Typically, nearly a seven-minute AM peak delay was encountered on I-93 in this area, while an eight-minute delay was experienced on the Mystic Bridge. Traveling each of these facilities would normally take slightly more than one minute under uncongested flow.

Only slightly lesser AM peak delays were experienced in and leading to the Sumner Tunnel in 1977. Here, the AM bottleneck point is the exit area from the tunnel where northbound traffic sorts itself from southbound and central area-destined traffic. In 1977, the Sumner Tunnel bottleneck typically created AM peak queues stretching from downtown Boston about one and one-half miles almost to the southbound on-ramp to Route 1A from Logan Airport. Average maximum AM peak delays in this queue were 6.5 minutes in 1977.

The Southeast Expressway also experienced substantial AM peak delays in 1977, averaging more than six minutes leading to the downtown area. These delays took place in intermittent queues because there is no well-defined AM peak bottleneck point, and because AM traffic departs the Expressway at several points north of Columbia Road before the final bottleneck point is reached at the Massachusetts Turnpike on-ramp merge just south of the Dewey Square Tunnel.

In addition to these delays, minor eastbound AM peak delays were experienced in 1977 on Storrow Drive and the Massachusetts Turnpike. Delays of over two minutes were experienced on Storrow Drive at the Leverett Circle traffic signal, and delays of almost one and one-half minutes took place on the ramp from the Massachusetts Turnpike to the Central Artery northbound.

During the PM peak, the bottlenecks of the expressway system created much larger queues and delays

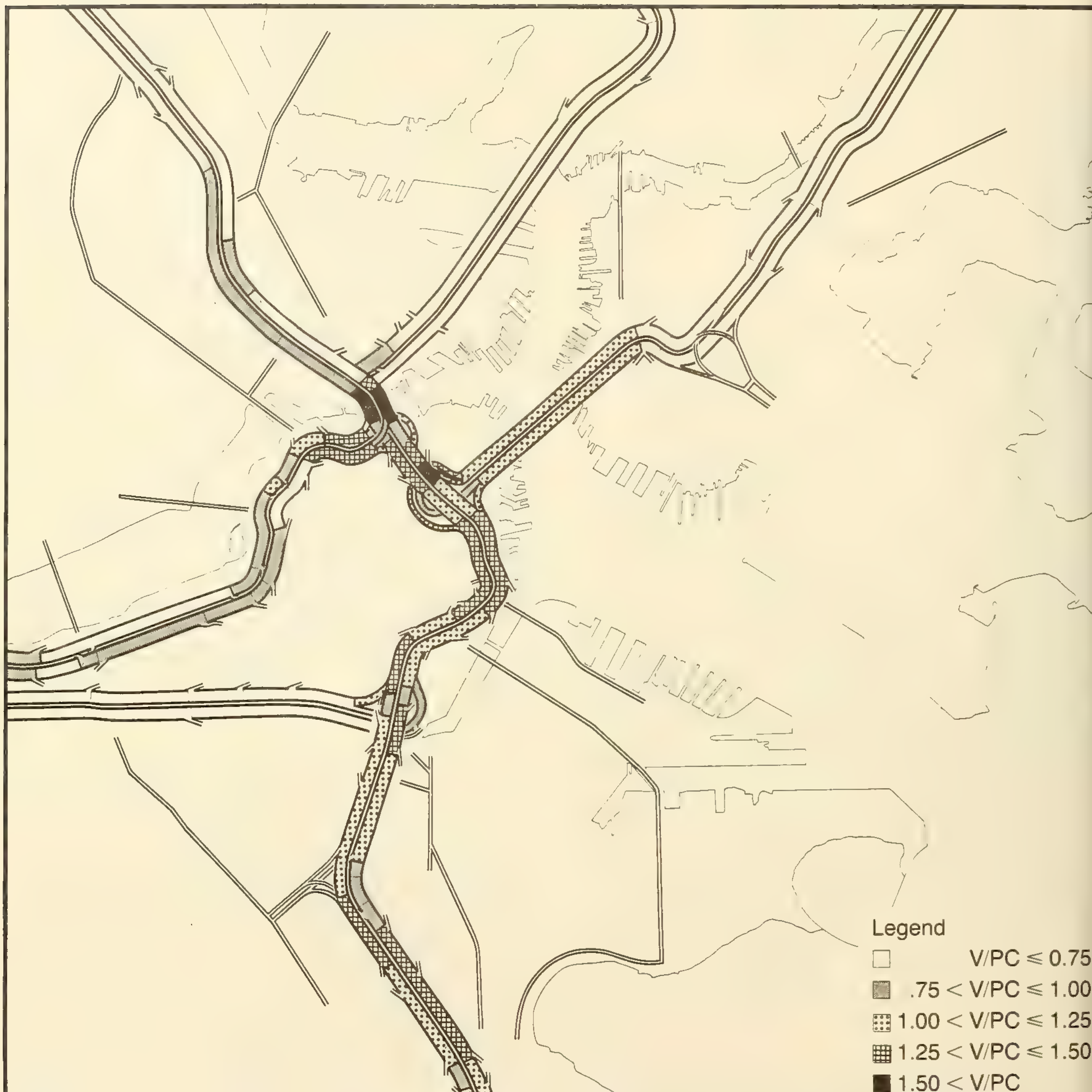


Figure 7

Base Case – 1977 – Daily Volume Relative to Practical Capacity

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Figure 8

Base Case – Mainline Queues and Delays – 1977 A.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

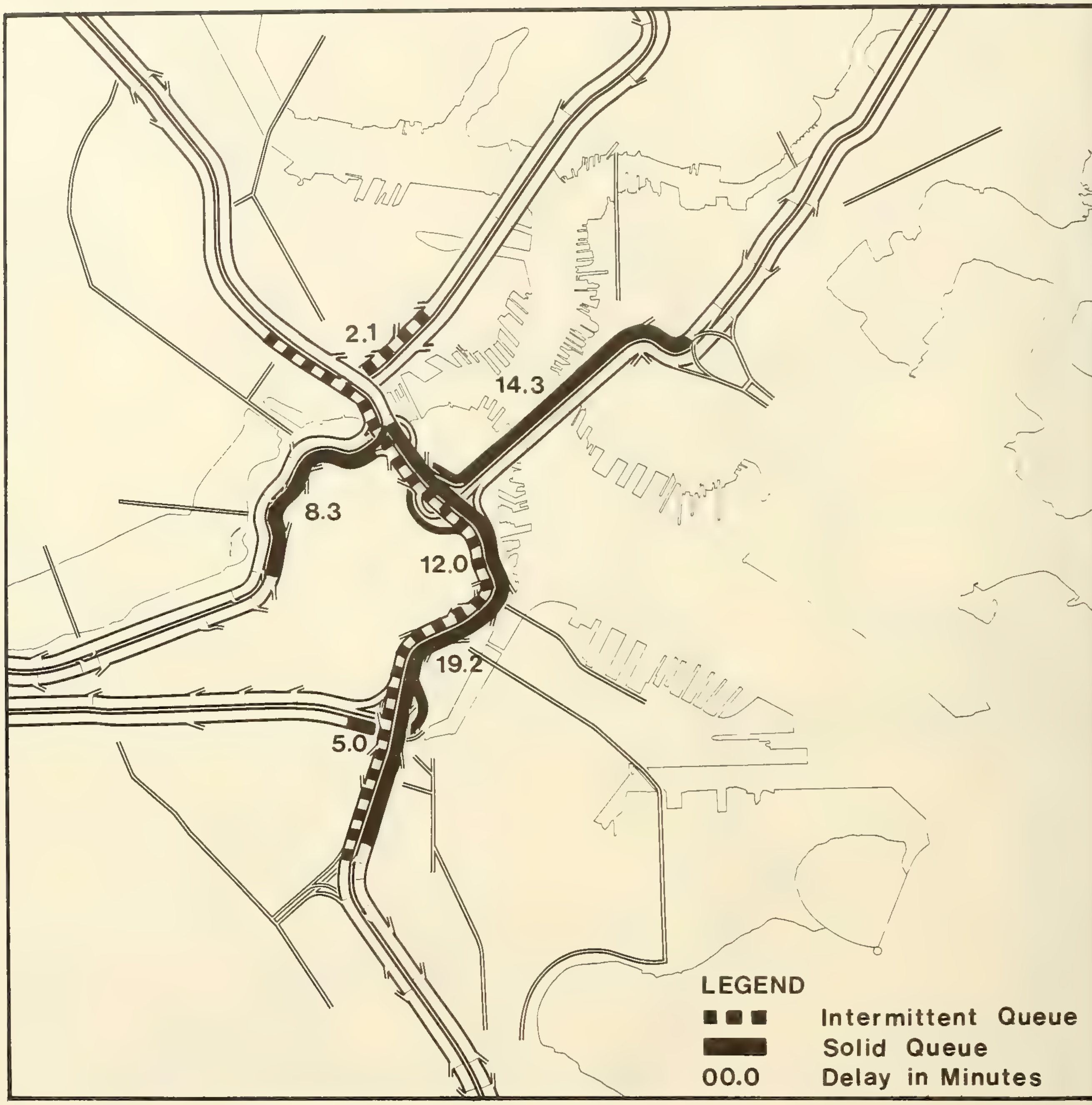


Figure 9

Base Case – Mainline Queues and Delays – 1977 P.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

in 1977 than they did in the AM peak. By far the greatest PM queues and delays were created by the bottleneck of the Central Artery Bridge where three northbound lanes of the Central Artery join with two lanes from Storrow Drive to enter a three-lane weaving section over the Bridge. This bottleneck in 1977 created a northbound queue on the Central Artery stretching back two and one-half miles to the Massachusetts Avenue interchange of the Southeast Expressway. This queue involved typical PM peak delays in excess of nineteen minutes. The Storrow Drive queue caused by the Artery Bridge bottleneck was also considerable in 1977, stretching back from the Bridge entry to beyond Longfellow Bridge. This queue entailed average maximum PM peak delays of almost eight and one-half minutes.

The Artery southbound also experienced major PM peak period delays in 1977. Although there was no well-defined bottleneck southbound on the Central Artery during the PM peak, very heavy PM peak period traffic in 1977 caused intermittent queuing from half-way between Sullivan Square and the Central Artery Bridge on I-93 to the Massachusetts Avenue off-ramp of the Southeast Expressway. This intermittent queuing typically was associated with PM southbound delays averaging about twelve minutes.

Large PM peak queues also existed in and leading to the Sumner Tunnel in 1977. In the PM peak, the bottleneck point associated with the Sumner Tunnel was the merge point with the Central Artery southbound. In 1977, PM peak queuing stretched from this point all the way to the Logan Airport on-ramp to Route 1A southbound, and entailed average maximum delays of over fourteen minutes.

Two other PM peak queues existed in the downtown Boston area expressway system during the PM peak period in 1977. The first was leading to the Central Artery bridge merge from the Mystic-Tobin Bridge. This was an intermittent queue stretching about half-way to the Mystic Bridge toll booths, and entailing delays of about two minutes. The second was the eastbound Massachusetts Turnpike queue leading to and on the ramp to the Central Artery northbound at the Dewey Square Tunnel portal. This was a solid queue entailing typical delays of about five minutes before entering the Central Artery northbound queue.

2.4 No-Build Alternative - Daily V/C, Queues, and Delays (1990)

Figure 10 shows daily volumes relative to practical capacities on the expressway system in 1990 for the No-Build Alternative. For the most part, the pattern of daily volume relative to practical capacity would be very similar to that of the 1977 Base Case, except that traffic volumes would be heavier. Outside of the immediate downtown area, most daily volumes would still below practical capacities. On the Southeast Expressway, the situation would actually improve because the No-Build Alternative includes the Southeast Expressway reconstruction project planned for 1984-1985.

Within the downtown area, the traffic situation would become worse. The Sumner and Callahan tunnels, which in 1977 were between 1.0 and 1.25 times practical capacity, are projected to be between 1.25 and 1.50 times practical capacity in 1990. Similarly, the Central Artery, which was mostly between 1.25 and 1.50 times practical capacity in 1977, would find about one-half of its length carrying volumes above 1.5 times practical capacity by 1990. A slight improvement would occur at the Central Artery Bridge in 1990 because of expected construction of the North Area Project. Storrow Drive would also experience increased volumes relative to practical capacities in 1990, with a number of segments that would rise to above practical capacity.

Increasing volumes for the No-Build Alternative would generally lead to longer queues and increased

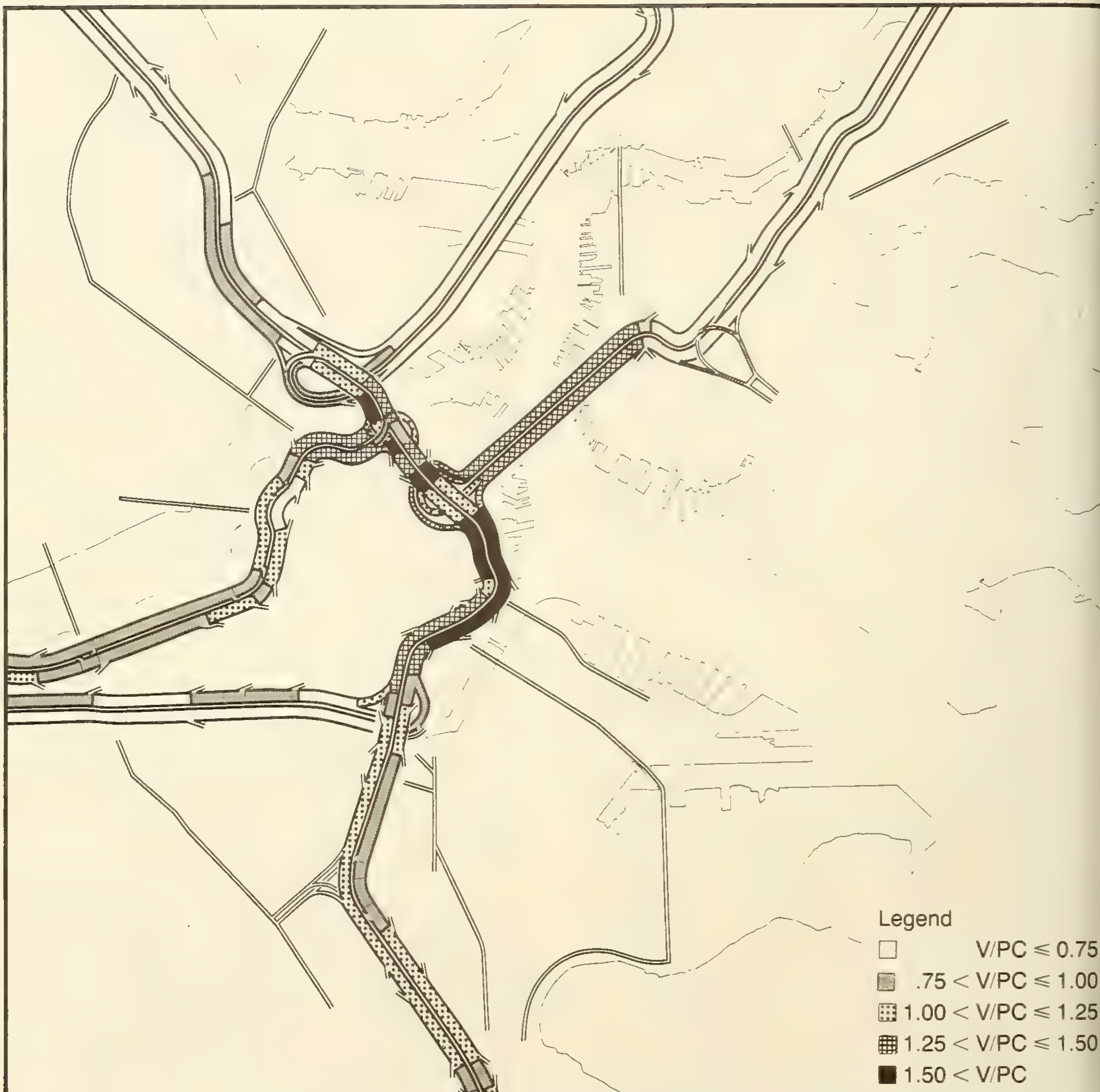


Figure 10

No-Build Alternative – 1990 – Daily Volume Relative to Practical Capacity

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

delays for the year 1990. This is shown for the AM peak period in Figure 11 and for the PM peak period in Figure 12.

During the AM peak, the longest delay in the No-Build Alternative would be 10.6 minutes on the Southeast Expressway northbound, up from 6.3 minutes in 1977. The queue would change from an intermittent queue to a solid one, due to Southeast Expressway reconstruction, which would create a distinct AM peak bottleneck at the northern end of the reconstruction area, at the entry to the Dewey Square Tunnel.

The 1990 No-Build delays would be almost as long southbound on I-93 and the Mystic-Tobin Bridge, with delays on each of these being projected at over ten minutes. The AM queue on I-93 would stretch more than two miles to well beyond Sullivan Square, and the Mystic Bridge queue would stretch almost to the toll booths. Because of North Area Project construction, the AM bottleneck point for these queues would no longer be the Charles River Bridge of the Central Artery, but would move south to the southbound merge point between the Central Artery and the Storrow Drive ramps.

Between 1977 and 1990, AM peak Sumner Tunnel delays would grow from 6.5 to 7.5 minutes, and the queue length would increase commensurately. Also, AM queuing would increase on Storrow Drive and on the Massachusetts Turnpike. Storrow Drive delays at the Leverett Circle traffic signal would increase from about two minutes in 1977 to over three minutes in 1990. Massachusetts Turnpike AM delays would increase from 1.3 to 1.5 minutes at the merge point with the Central Artery northbound.

PM peak queues and delays would also increase between the 1977 Base Case and the No-Build Alternative for 1990. Southbound on the Central Artery, delays in intermittent queuing would increase from twelve to more than fifteen minutes, with the area of intermittent queuing stretching from the Sullivan Square off-ramp on I-93 to the south portal of the Dewey Square Tunnel, where the Southeast Expressway reconstruction project begins. Northbound on the Central Artery, delays actually would stay about the same at just over nineteen minutes. This is because some bottleneck relief would be provided by the North Area Project. Because of North Area Project construction, the northbound PM bottleneck on the Central Artery would move from the Central Artery/Charles River Bridge to the merge point between the Artery and the northbound on-ramp from the Sumner Tunnel. The northbound PM Artery queue would stretch to a point about half-way between the Columbia Road on-ramp and the Frontage Road off-ramp.

Major increases would occur in PM queuing in the Sumner Tunnel, on the Mystic Bridge, on Storrow Drive, and on the Massachusetts Turnpike. Sumner Tunnel queuing delays would increase from a little over fourteen minutes to almost eighteen minutes, and the Sumner Tunnel queue would stretch from the Artery entry southbound all the way to the crossroad on the Logan Airport roadway system. On the Mystic Bridge, more than seven minutes of southbound delays would be encountered before motorists would join Central Artery southbound queuing just north of the Charles River at the merge point with southbound I-93 traffic. Storrow Drive delays would increase from 8.3 to 9.2 minutes, and the projected PM eastbound queue would stretch from the Central Artery to beyond the Arlington Street off-ramp. Finally, Massachusetts Turnpike delays would increase from five to almost eight minutes before joining the northbound Artery queue at the Dewey Square Tunnel portal. The Massachusetts Turnpike eastbound queue in 1990 is projected to stretch to about Clarendon Street.

2.5 Alternative 3 - Daily V/C, Queues, and Delays (1990)

The difference between

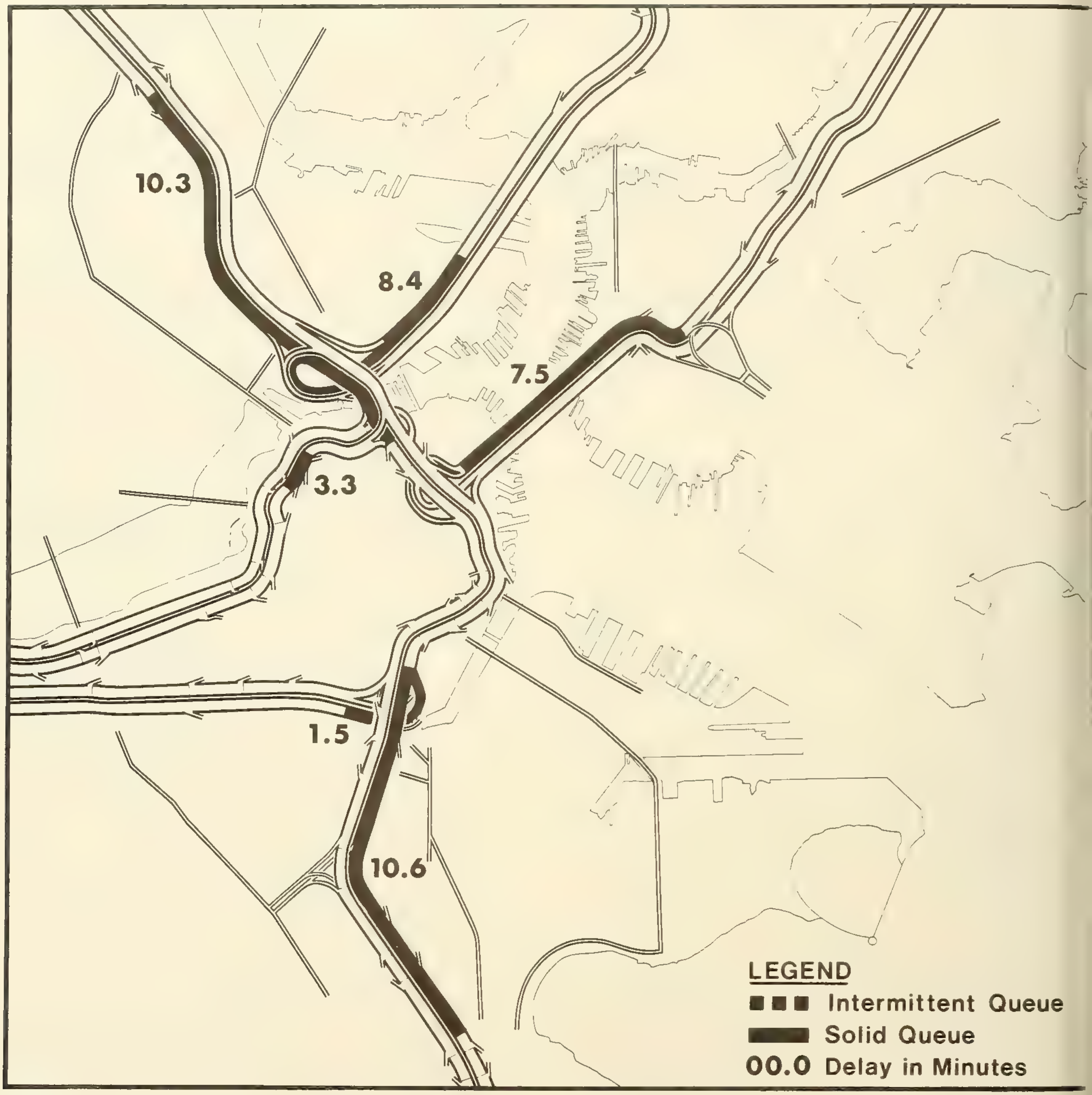


Figure 11

No-Build Alternative – Mainline Queues and Delays–1990 A.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

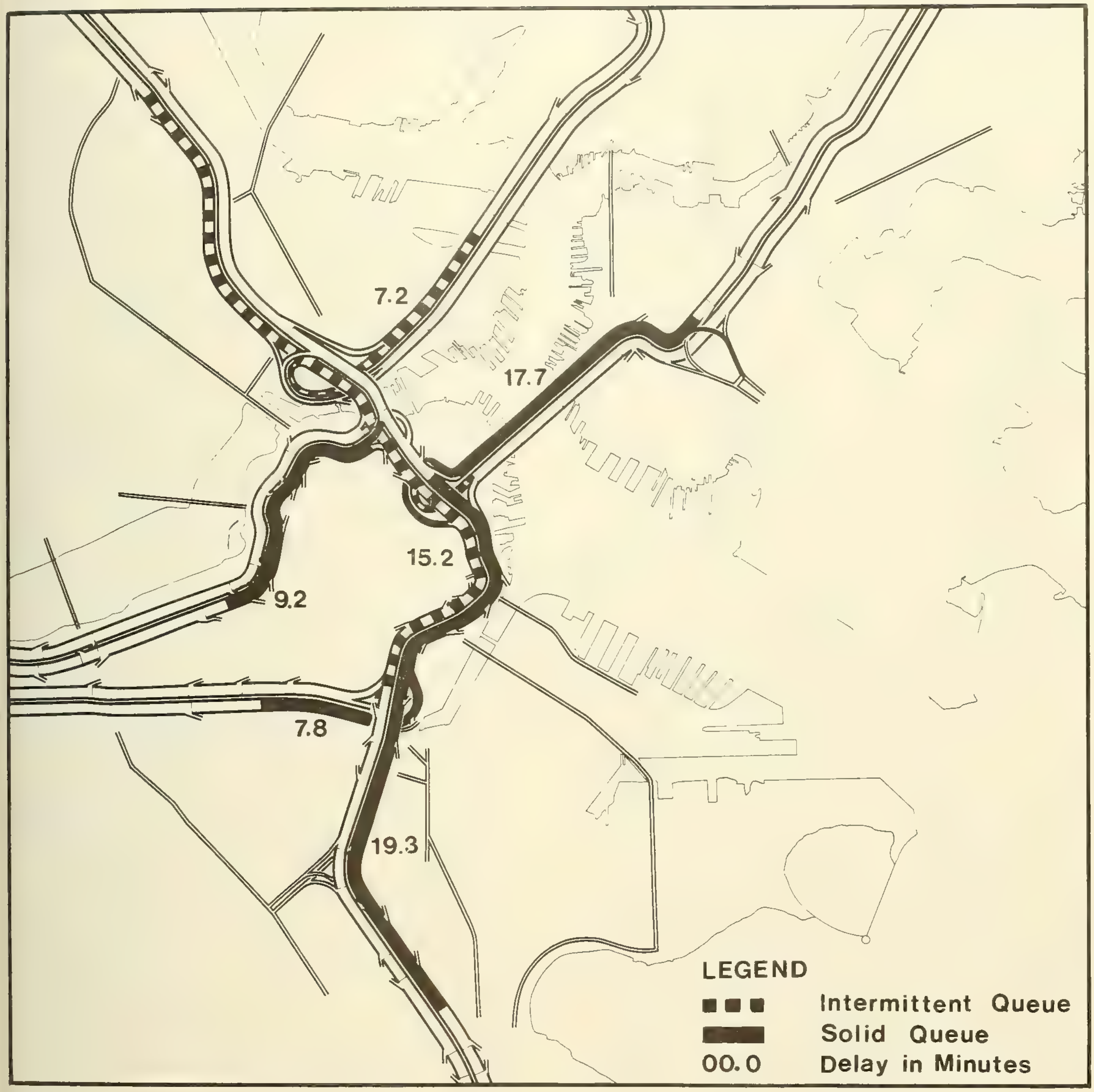


Figure 12

No-Build Alternative – Mainline Queues and Delays – 1990 P.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Alternative 3 and the No-Build Alternative is that in Alternative 3, a Third Harbor Tunnel is constructed with a split alignment in Fort Point Channel and a Jeffries Cove alignment in East Boston. The effects of this on daily traffic compared with practical capacity are illustrated in Figure 13. As shown in the figure, the major change in the ability of the expressway system to handle projected traffic would be in the harbor crossings themselves and in the split alignment portion of the Central Artery. Traffic on Sumner and Callahan Tunnels would drop in volume to below practical capacity, as opposed to being between 1.25 and 1.50 times practical capacity in the No-Build Alternative. A similar change would happen in the split alignment portion of the Central Artery where volumes would be below practical capacities because of the substantial new capacity provided by the split alignment. Also, traffic volumes in the Third Harbor Tunnel would be below practical capacity.

However, on the Central Artery north of the split alignment, very little would occur to bring volumes into accord with practical capacities. In the No-Build Alternative, a number of segments of the central portion of the Central Artery would operate at more than 1.5 times practical capacity, and most of the remainder would operate at between 1.25 and 1.50 times practical capacity. In Alternative 3, few segments would drop to below 1.50 times practical capacity because of Third Harbor Tunnel diversions, but most of the central portion of the Central Artery would still operate at above 1.25 times practical capacity, and part of the Artery would still be above 1.50 times practical capacity.

Outside of the downtown Boston area, there would be almost no changes in volumes relative to practical capacities. There would be a small shift in traffic volumes from Storrow Drive to the Massachusetts Turnpike, with some segments of Storrow Drive going from above practical capacity to below. On the Massachusetts Turnpike, even with the increased volumes, volumes would still remain well below practical capacities.

The AM and PM peak queuing impacts of these changes are shown in Figure 14 and Figure 15. Queuing in Alternative 3 would result almost solely from Central Artery bottlenecks rather than harbor crossing bottlenecks, because harbor crossing capacities in Alternative 3 are adequate.

Figure 14, illustrates projected AM peak queues for Alternative 3. The AM southbound queues on I-93 and the Mystic Bridge would still be substantial, at almost ten minutes for each facility. This represents a drop of less than one minute from the No-Build Alternative. It is caused by the fact that volumes for these facilities would not be substantially affected by the Third Harbor Tunnel, and because the bottlenecks of the central portion of the Artery are not changed. Sumner Tunnel AM queuing, however, would almost be entirely eliminated by the Third Harbor Tunnel. AM peak delays on this facility would drop from 7.5 minutes in the No-Build Alternative to only 1.5 minutes in Alternative 3. Southeast Expressway AM northbound delays would also be dramatically reduced from more than ten minutes to less than four minutes. This is because the split alignment would eliminate the AM peak Dewey Square Tunnel bottleneck leading to downtown Boston. For the same reason, eastbound AM peak delays on the Massachusetts Turnpike would be eliminated by this alternative.

Some minimal AM inbound delays would occur in this Alternative on the Third Harbor Tunnel. These amount to about a minute. Also, some AM delay would still persist on Storrow Drive at the Leverett Circle traffic lights: about 2.5 minutes, as compared to the 3.3 minutes of the No-Build Alternative.

During the PM peak period, a

Figure 13

Alternative 3 – 1990 – Daily Volume Relative to Practical Capacity

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Figure 14

Alternative 3 – Mainline Queues and Delays – 1990 A.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

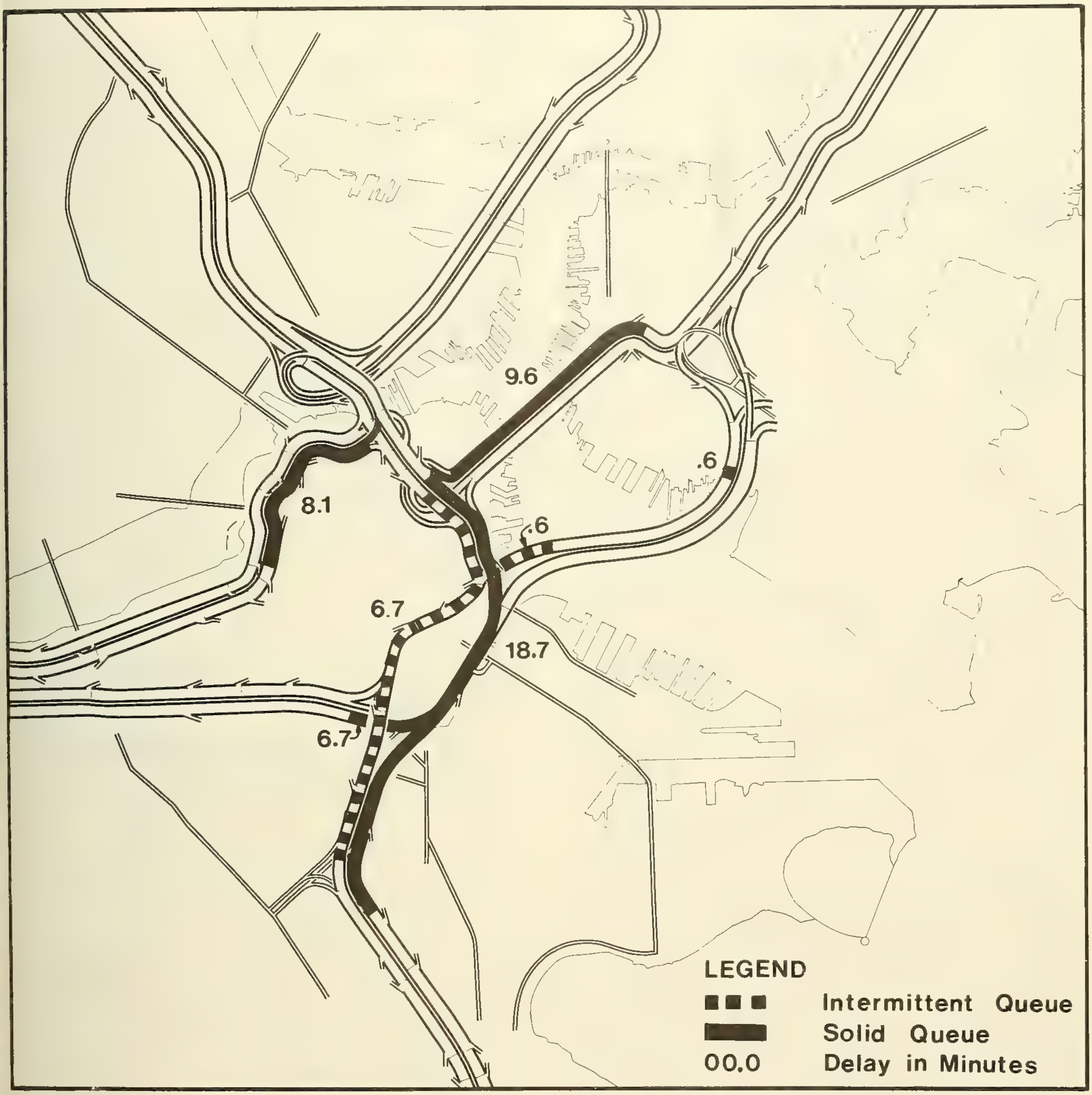


Figure 15

Alternative 3 – Mainline Queues and Delays – 1990 P.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

similar circumstance to that of the AM would occur with major queues associated with Central Artery congestion, but almost none related to harbor crossing capacity. As shown in Figure 15, the northbound Artery queue would be almost unchanged, with delays dropping only from a little over nineteen minutes to a little less than nineteen minutes. The Alternative 3 northbound Artery queue would stretch back from the Artery-Sumner Tunnel northbound on-ramp merge point bottleneck all the way to the Massachusetts Avenue off-ramp -- a distance of almost two and one-half miles. Southbound Central Artery PM outbound queuing would be substantially reduced from about fifteen minutes in the No-Build Alternative to a little over seven in Alternative 3. This decrease would be caused by the greater southbound Artery capacity provided by the double-bareled southbound Dewey Square Tunnel in the split alignment. As with the No-Build Alternative, the Alternative 3 southbound Artery queue is intermittent because of the lack of well-defined bottlenecks.

In Alternative 3, even though there would be almost no PM Third Harbor Tunnel queuing, there would be a more than nine minute queue in the Sumner Tunnel. This would be caused by the substantial flows of traffic from the airport destined to points to the northwest and west, which must go through the congested central portion of the Central Artery to reach their destinations. Similarly, eastbound Storrow Drive delays would only be diminished by about one minute between the No-Build Alternative and Alternative 3. The resulting eastbound PM Storrow Drive delays of about eight minutes would again be due to the fact that Artery congestion north of the split alignment would not have been substantially eased in this alternative. Massachusetts Turnpike eastbound PM queuing would also not be substantially affected by this alternative. Delays leading to the northbound Artery queue would be reduced only from about eight minutes in the No-Build Alternative to a little less than seven in Alternative 3.

2.6 Alternative 5 - Daily V/C, Queues, and Delays (1990)

Alternative 5 is very similar to Alternative 3. As is the case with Alternative 3, Alternative 5 would include a four-lane Third Harbor Tunnel to the Jeffries Cove area of East Boston, but would not depress or widen the Central Artery. The major difference between Alternative 5 and Alternative 3 is that Alternative 5 would not include a split alignment for the Central Artery. Rather, operations of the Dewey Square Tunnel would be left much as they are today, and both directions of the Third Harbor Tunnel would connect to the Artery at the Massachusetts Turnpike, and utilize Fort Point Channel as the route to the harbor crossing itself.

Daily volumes relative to practical capacities are shown for Alternative 5 in Figure 16. As might be expected, they would be almost identical to those of Alternative 3, except in the Dewey Square Tunnel-Fort Point Channel area. As with Alternative 3, harbor crossing volumes in Alternative 5 would be below practical capacities, while volumes on the Central Artery, particularly north of the Dewey Square Tunnel, would generally be well above practical capacities. North of the Dewey Square Tunnel, Artery volumes would be typically between 1.25 and 1.50 times practical capacity, with some segments above 1.50 times practical capacity. In the Dewey Square Tunnel itself, volumes would be generally between practical capacity and 1.25 times practical capacity. Elsewhere in the downtown area express highway system, differences between the two alternatives would be minimal.

With daily volumes relative to practical capacities very similar in Alternative 5 to what they are in Alternative 3, queues and delays would likewise be much the same. This may be seen for the AM peak period in Figure 17. On I-93 southbound and the

Figure 16

Alternative 5 – 1990 – Daily Volume Relative to Practical Capacity

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

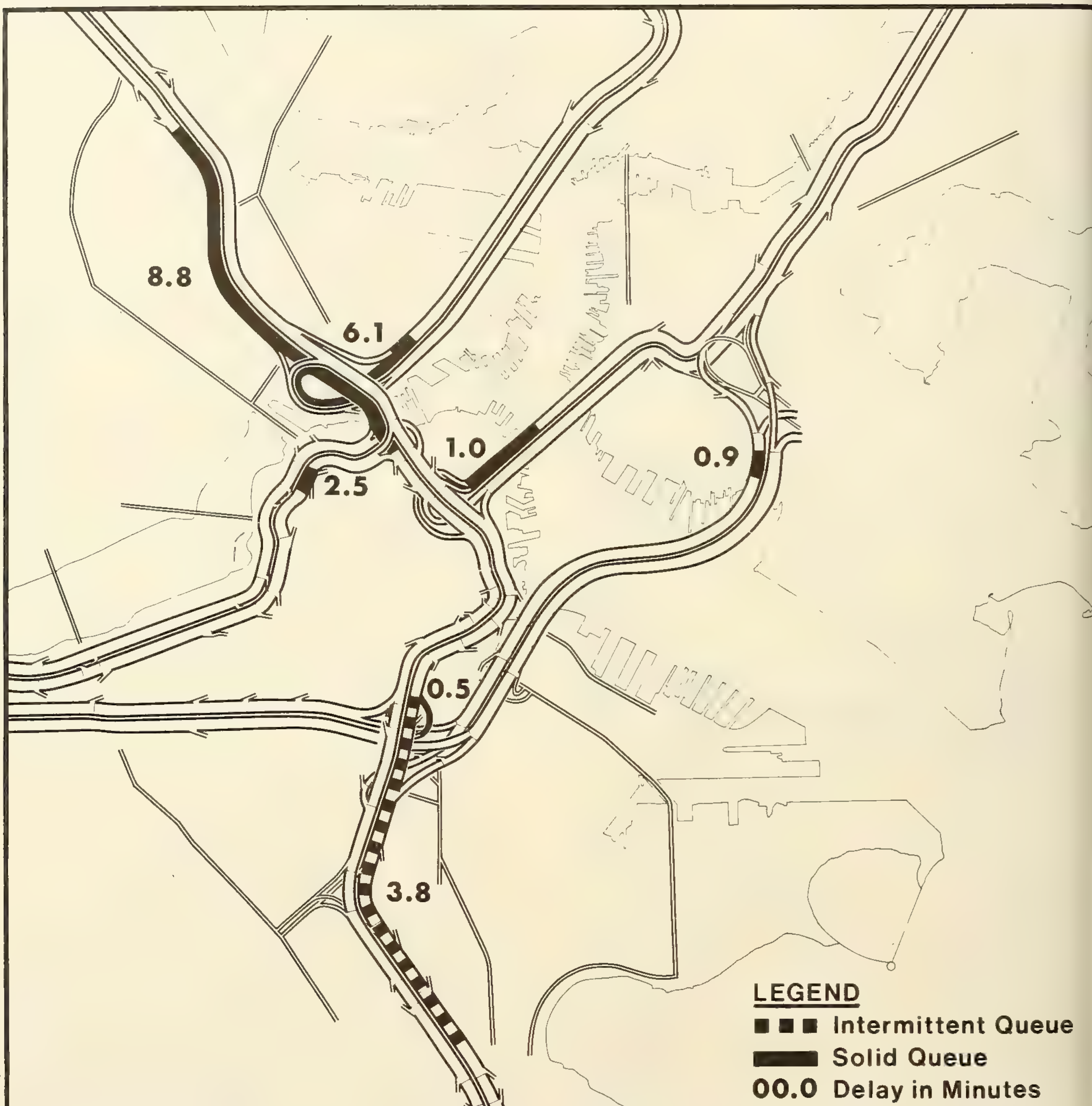


Figure 17

Alternative 5 – Mainline Queues and Delays – 1990 A.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Mystic-Tobin Bridge inbound, AM delays would be almost nine minutes. These delays would be almost the same as those for Alternative 3, which reflects the fact that Central Artery bottlenecks are not relieved by either Alternative 5 or Alternative 3. Because of adequate harbor crossing capacity in Alternative 5, AM peak delays in the Sumner Tunnel and the Third Harbor Tunnel would be minimal, just as they are in Alternative 3. Southeast Expressway delays would also be just about the same (3.8 minutes) because of elimination of Airport-bound traffic before the Dewey Square Tunnel is reached from the south.

PM peak queues and delays, shown in Figure 18, would also be much the same in Alternative 5 as in Alternative 3. Northbound delays on the Central Artery would average almost nineteen minutes because of inadequate Artery capacity, with the northbound bottleneck point being the merge point of Artery traffic with that from the Sumner Tunnel. The northbound Artery queue in Alternative 5 would stretch to beyond the Massachusetts Avenue interchange. Southbound Artery delays in Alternative 5 would almost be the same as in Alternative 3 at just under seven minutes. Because there would be no well-defined bottleneck, these delays would be experienced in intermittent queuing rather than in a solid queue. To the extent that there would be a bottleneck point, it would appear to be the merge point of the Massachusetts Avenue on-ramp with the Central Artery at the Massachusetts Avenue interchange.

Just as with Alternative 3, Alternative 5 would result in delays of about nine minutes in and leading to the Sumner Tunnel. The reason in Alternative 5 is the same as in Alternative 3: inadequate ability of traffic from Logan Airport to enter and traverse the northbound section of the Artery between the Sumner Tunnel on-ramp and the Route 1 off-ramp. PM Third Harbor Tunnel delays in this alternative would amount to about four minutes leading to the entry to the Central Artery/Southeast Expressway near the Massachusetts Avenue interchange. This delay would be experienced in Alternative 3 mostly in the Dewey Square Tunnel. In this alternative, the delay is about the same; it is merely displaced to the new facility.

The final PM queue in this alternative, that of Storrow Drive eastbound, would also be about the same in Alternative 5 as it would be in Alternative 3: it involves delays of about eight minutes and stretches to beyond the Longfellow Bridge. The cause of this delay, as with Alternative 5, would be inadequate ability to enter the congested Central Artery.

2.7 Alternative 6 - Daily V/C, Queues, and Delays (1990)

While Alternatives 3 and 5 include the construction of a four-lane Third Harbor Tunnel, but not the depression or widening of the Central Artery, Alternative 6 includes the depression and widening of the Central Artery (including a Split Alignment in the southern part of downtown Boston), but does not build a new harbor crossing. The effects of this on daily traffic compared with practical capacity are illustrated in Figure 19. As can be seen in the figure, Central Artery volumes relative to capacities would be reduced to the point where at no location are Artery volumes more than 1.25 times daily practical capacity. Sumner and Callahan tunnel volumes, however, would both be between 1.25 and 1.50 times practical capacity, just as in the No-Build Alternative.

The results of this on peak period queues and delays are shown for the AM peak in Figure 20 and for the PM peak in Figure 21. During the AM peak, queues and delays from the north via I-93 and Route 1 would be dramatically reduced from around 8-10 minutes in the No-Build Alternative to 2.7 minutes in Alternative 6. This would be because of substantial

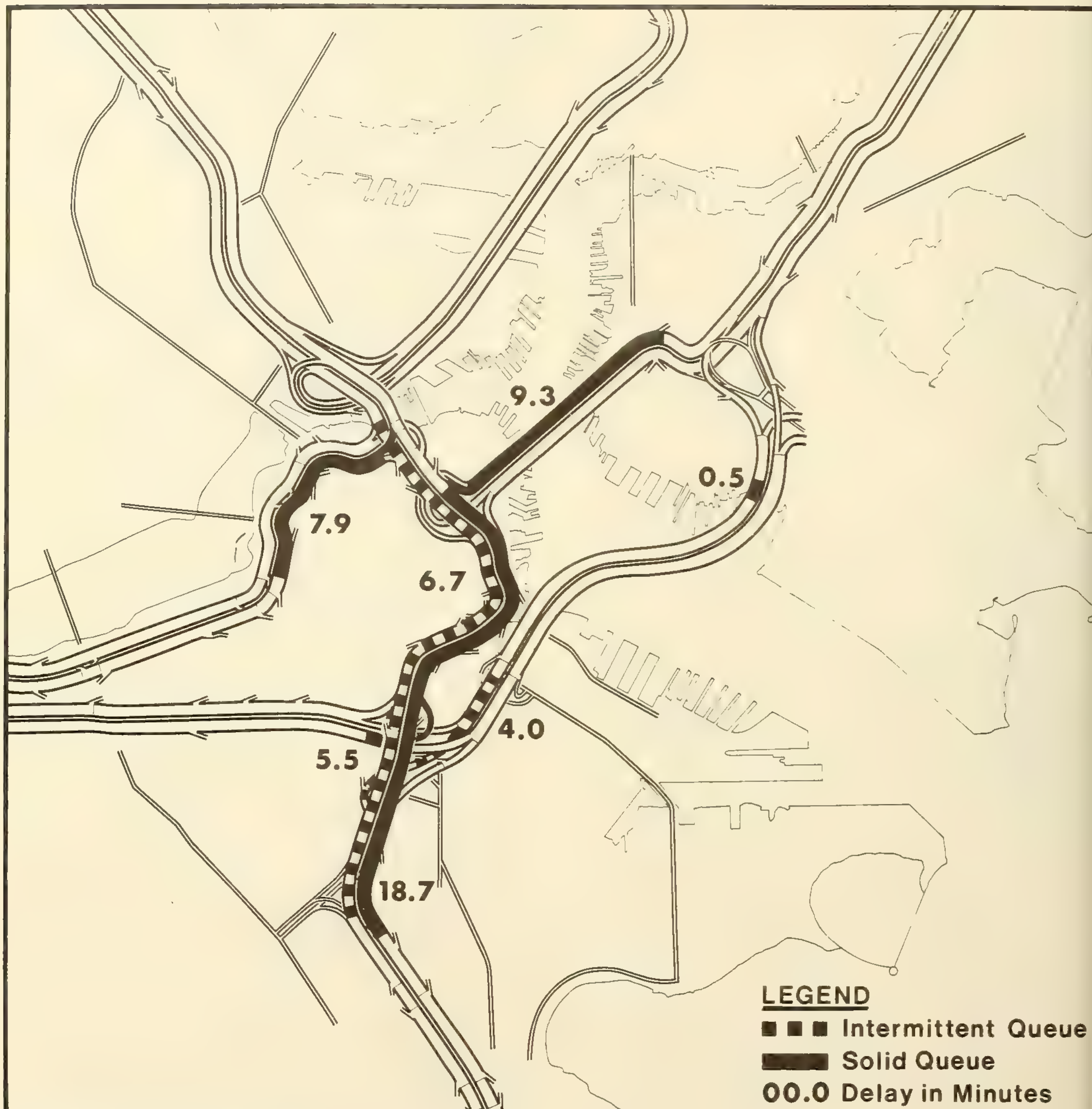


Figure 18

Alternative 5 – Mainline Queues and Delays – 1990 P.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

gure 19

lternative 6 – 1990 – Daily Volume Relative to Practical Capacity

IS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

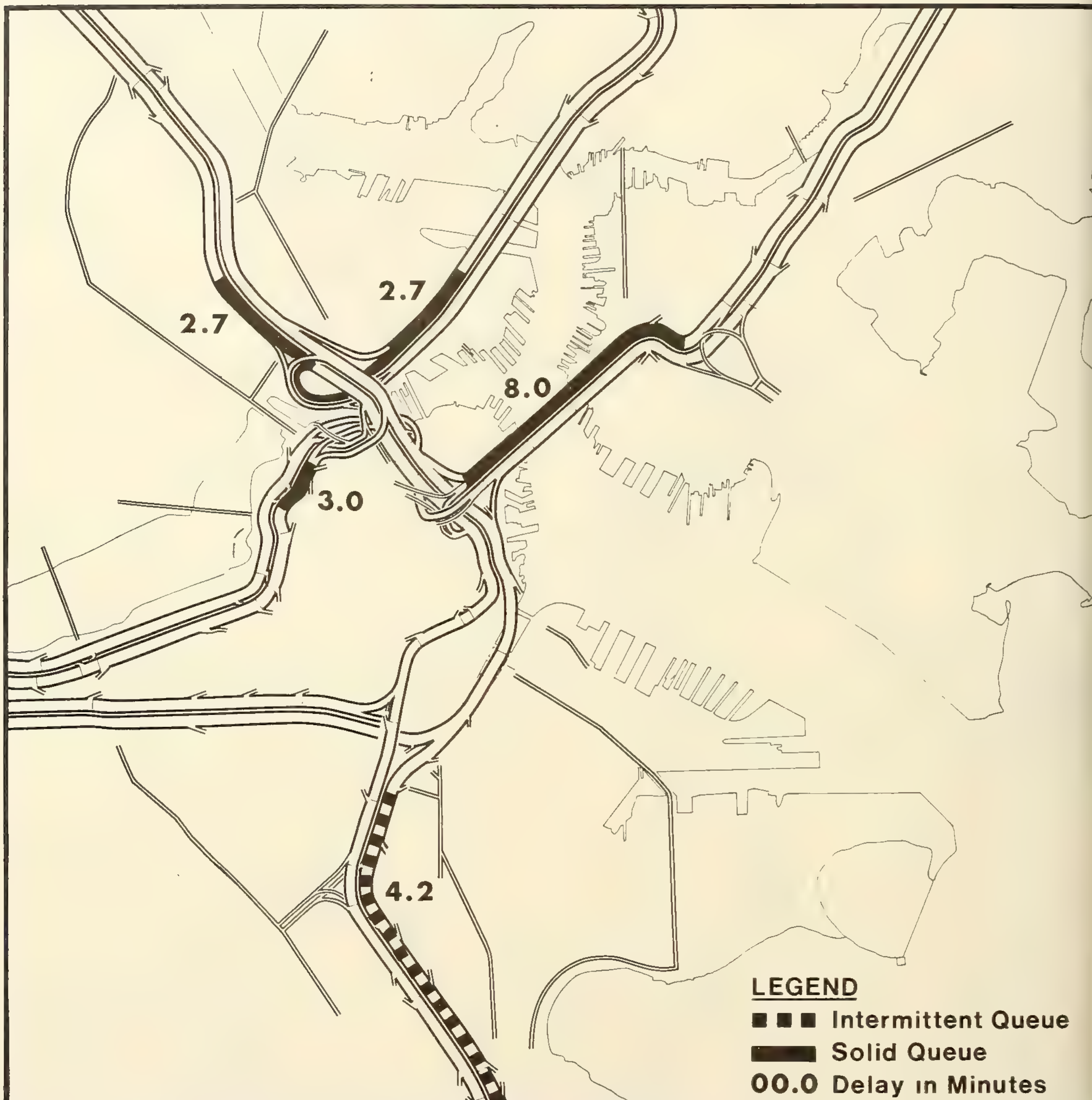


Figure 20

Alternative 6 – Mainline Queues and Delays – 1990 A.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Figure 21

Alternative 6 – Mainline Queues and Delays – 1990 P.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

elimination of the Central Artery Bridge and Central Artery as AM peak bottlenecks. Delays in and leading to the Sumner Tunnel, however, would remain almost what they were in the No-Build Alternative: 8.0 minutes for Alternative 6 compared with 9.6 minutes in the No-Build Alternative. This would be because the tunnel bottleneck remains. From the south, delays on the Southeast Expressway would be much the same as they were in Alternative 3, about four minutes. This is because both Alternative 6 and Alternative 3 would provide increased capacity to the downtown Boston area via the Split Alignment.

PM peak queues and delays would also show the effects of substantial elimination of Central Artery bottlenecks, but not of the Sumner-Callahan Tunnel bottleneck. On the Central Artery northbound, the nineteen-minute delays of the No-Build Alternative and Alternative 3 would be reduced by almost half to 10.6 minutes. For northbound Artery traffic, the Central Artery no longer would present the greatest constraint on traffic, but rather the Callahan Tunnel entry. A similar phenomenon would exist for traffic to the Callahan Tunnel from the northwest and west. Delays from the Callahan Tunnel mouth would accumulate 4.4 minutes on the Callahan ramps and Artery southbound, and then another 8.3 minutes on Storrow Drive, with queues stretching beyond the Arlington Street off-ramp.

PM peak Sumner Tunnel delays in Alternative 6 would be reduced slightly to 14.5 minutes from the 17.7 minutes of the No-Build Alternative. Typical PM peak Sumner Tunnel queues would still stretch onto the Logan Airport roadway system. Any reduction that would take place in Sumner Tunnel queuing would be due to small diversions to the Mystic-Tobin bridge in Alternative 6, and to increased ramp access to the Central Artery from the downtown Boston portal of the Sumner Tunnel.

In addition to the above, two other PM queues would exist in Alternative 6. The first is an 8.3-minute intermittent queue southbound on the Central Artery leading to the Southeast Expressway. This queue is primarily caused by capacity constraints on the Southeast Expressway. In addition, there is a five-minute queue on the Massachusetts Turnpike eastbound leading to the Central Artery northbound. As with the northbound Artery queue, this delay relates to congestion leading to the Callahan Tunnel entry.

2.8 Alternatave 3A - Daily V/C, Queues, and Delays (1990)

Alternative 3A includes both Artery widening and depression, and a four-lane Third Harbor Tunnel. The artery would be widened mostly to four lanes, but with five lanes between certain on- and off-ramps, and with a Split Alignment in the southern portion of downtown Boston. The Third Harbor Tunnel would go from the Split Alignment to Jeffries Point in East Boston, much as in Alternative 3. This alternative would relieve both Central Artery and harbor crossing-related bottlenecks. As shown in Figure 22, which illustrates daily V/C statistics for Alternative 3A, almost the entire Central Artery would have traffic volumes that are less than practical capacity. The same is true of the harbor crossings. Both the Sumner and Callahan tunnels and the Third Harbor Tunnel are between 0.75 and 1.00 times practical capacity.

The result of lowering daily volumes relative to capacities for both the Central Artery and the harbor crossings would be dramatically lessened queuing both in the AM and the PM peaks. During the AM peak period, as shown in Figure 23, the maximum inbound delay on any route would be 4.0 minutes on the Southeast Expressway. Route I-93 and Mystic-Tobin Bridge delays would be 2.4 minutes; Sumner Tunnel delays would be 1.3 minutes; Storrow Drive delays would be 2.9 minutes; and, Massachusetts Turnpike delays would be

Figure 22

Alternative 3A – 1990 – Daily Volume Relative to Practical Capacity

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

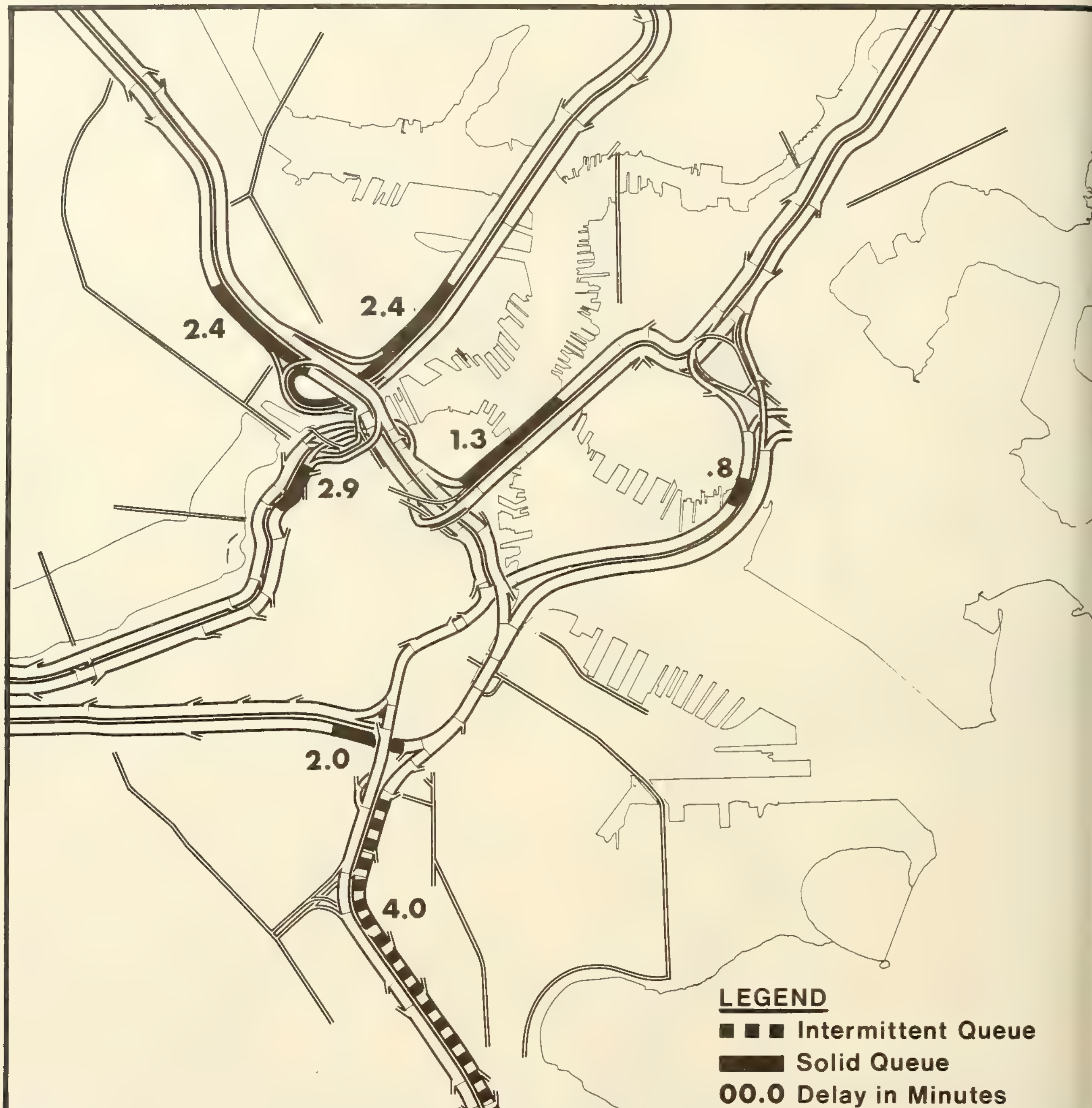


Figure 23

Alternative 3A – Mainline Queues and Delays–1990 A.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

Table 2

RELOCATION REQUIREMENTS[1] (Cont'd)

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
26	National Car Rental Logan Airport	Car rental	120	rent	9,400	140,000
27	Hertz Rent-A-Car (partial) Logan Airport	Express rental	15	rent		41,000
28	Exxon Service Station Logan Airport	Service Station	14	rent	1,950	38,300
29	Central Air Freight Terminal Logan Airport	Freight forwarding				
	ABC Air Freight	Freight forwarding	11	rent	4,050	
	Airport Express Freight	Freight forwarding	6	rent	950	
	D & J Motor Company	Freight forwarding	22	rent	4,000	
	Morrison Express International	Freight forwarding	7	rent	912	
	APE International	Freight forwarding	9	rent	1,000	
	Allied Air Freight	Freight forwarding	4	rent	800	
	Direct Courier	Freight forwarding	1	rent	200	

Table 2

RELOCATION REQUIREMENTS[1] (Cont'd)

Location Number[2]	Building/Business Identification and Location	Type of Business	No. of Employees	Tenure	Leaseable Floor Area(sf)	Parcel Area(sf)[3]
30	United Air Flight Kitchen Logan Airport	Catering	70	rent	12,000	
31	Robie Airport Park[7] (partial taking) 161 Prescott St., E. Boston					
	Federal Express	Freight Forwarding	32	rent	19,700	
	Avis Car Maintenance		42	rent	35,700	5,560

Figure 24

Alternative 3A – Mainline Queues and Delays – 1990 P.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

2.0 minutes. The Third Harbor Tunnel would have a small delay of 0.8 minutes southbound at the toll booths in East Boston.

Central Artery and harbor crossing-related delays during the PM peak would tend to be similarly small. As shown in Figure 24, northbound Central Artery delays would only be 3.0 minutes, and Sumner Tunnel delays would be 1.2 minutes. Third Harbor Tunnel delays would be 0.5 minutes southbound and 1.4 minutes northbound. On the Massachusetts Turnpike, there would be no PM peak period delays.

The only substantial PM peak queues and delays for Alternative 3A would be on Storrow Drive and the Central Artery southbound. The Storrow Drive eastbound delay of 6.9 minutes would remain because no attempt has been made in Alternative 3A (or any alternative) to deal with the Leverett Circle problem. The southbound Central Artery delays of 7.3 minutes would be related not to inadequate Central Artery capacity, but to inadequate capacity of the Southeast Expressway.

2.9 The Preferred Alternative - Daily V/C, Queues, and Delays (1990)

The Preferred Alternative is almost the same as Alternative 3A, except that the southern portion of the Third Harbor Tunnel begins in South Boston rather than in the Fort Point Channel area of the Split Alignment. Within the South Boston area, the Preferred Alternative has a two-part interchange connecting to Summer Street and Northern Avenue.

The similarity between the Preferred Alternative and Alternative 3A is readily seen in the daily V/C statistics illustrated in Figure 25 for the Preferred Alternative. As with Alternative 3A, most of the Central Artery would have daily volumes that are less than practical capacity (and those segments shown with volumes above practical capacity would have volumes that are only jus barely above practical capacity). Similarly, both the Sumner-Callahan tunnels and the Third Harbor Tunnel would have volumes that are less thar practical capacity. As with all of the other alternatives, I-93, Route 1 and Route 1A traffic volumes would be all less than 0.75 of daily practical capacity; Storrow Drive and the Massachusetts Turnpike would tend to range from less than 0.75 of practica capacity to between 0.75 of practical capacity and 1.00 times practical capacity. The Southeast Expressway would mostly be between 1.00 times practical capacity and 1.25 times practical capacity.

The similarity between daily volume/capacity relationships for Alternative 3A and the Preferred Alternative can also be seen in the A and PM peak queues and delays. Durin the AM peak, illustrated in Figure 26 queuing delays would again be minimal ranging downward from 3.6 minutes northbound on the Southeast Expressway. AM peak delays on I-93 and the Mystic-Tobin Bridge southboun would be 2.5 minutes. Sumner Tunnel delays would be 1.3 minutes. Third Harbor Tunnel delays southbound in South Boston would be about 2 minutes. Massachusetts Turnpike eastbound delays would be 1.6 minutes and Storrow Drive eastbound delays would be 2.5 minutes.

During the PM peak, queues and delays in the Preferred Alternative would reflect the same traffic circumstance as Alternative 3A: relief of the Central Artery and harbor crossing bottlenecks, but not of capacity constraints related to Leverett Circle and the Southeast Expressway. Thus, as shown in Figure 27, northbound Central Artery delays would be 3.3 minutes; Sumner Tunnel delays would be 1.4 minutes; and, northbound Third Harbor Tunnel delays would be 0.8 minutes. But, eastbound Storrow Drive delays remain at 6.9 minutes leading to Leverett Circle, and Southbound Central Artery delays would be 7.6 minutes leading to the Southeast Expressway. Similarly,

Figure 25

Preferred Alternative – 1990 – Daily Volume Relative to Practical Capacity

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

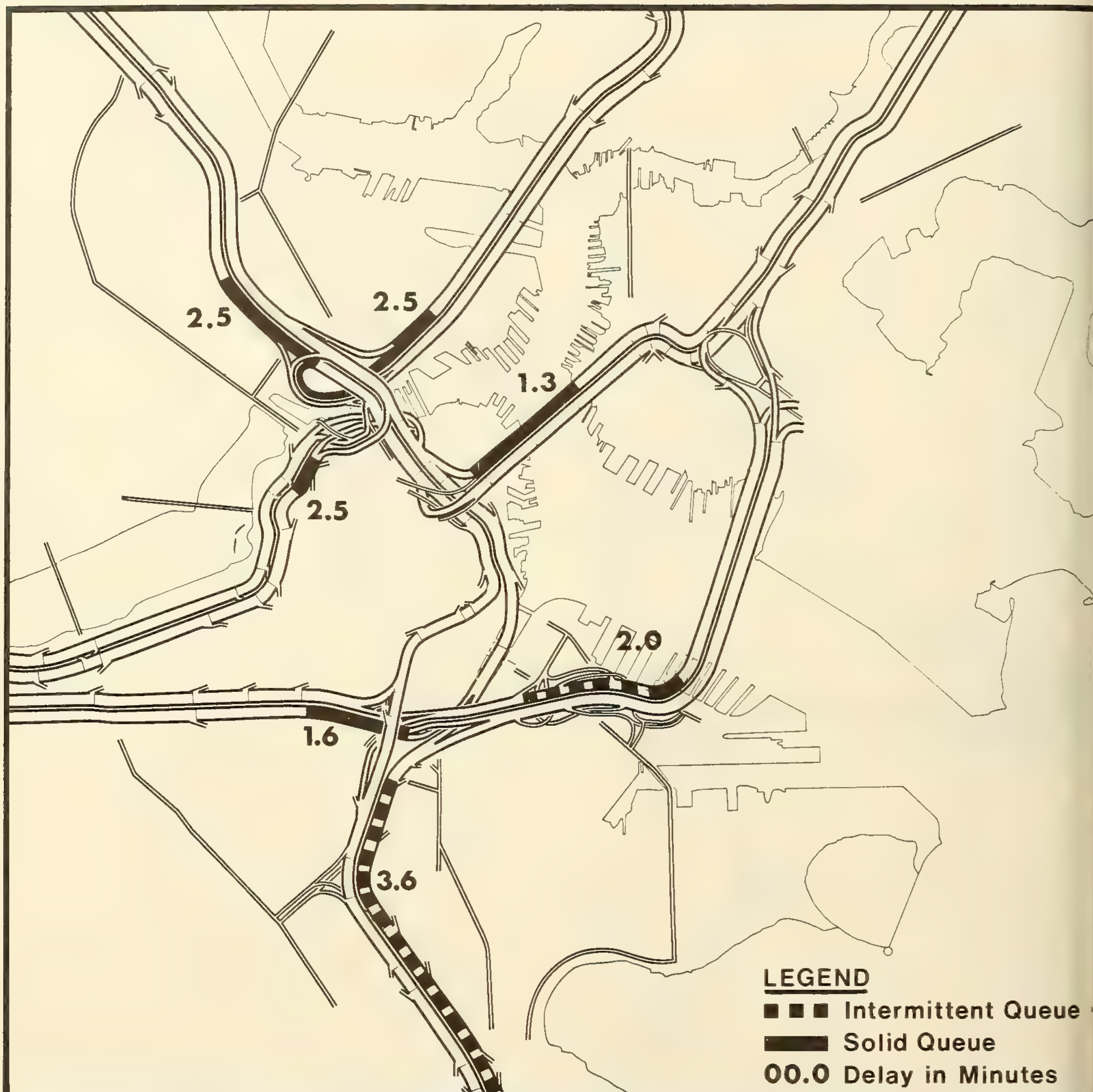


Figure 26

Preferred Alternative – Mainline Queues and Delays–1990 A.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

Figure 27

Preferred Alternative – Mainline Queues and Delays–1990 P.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

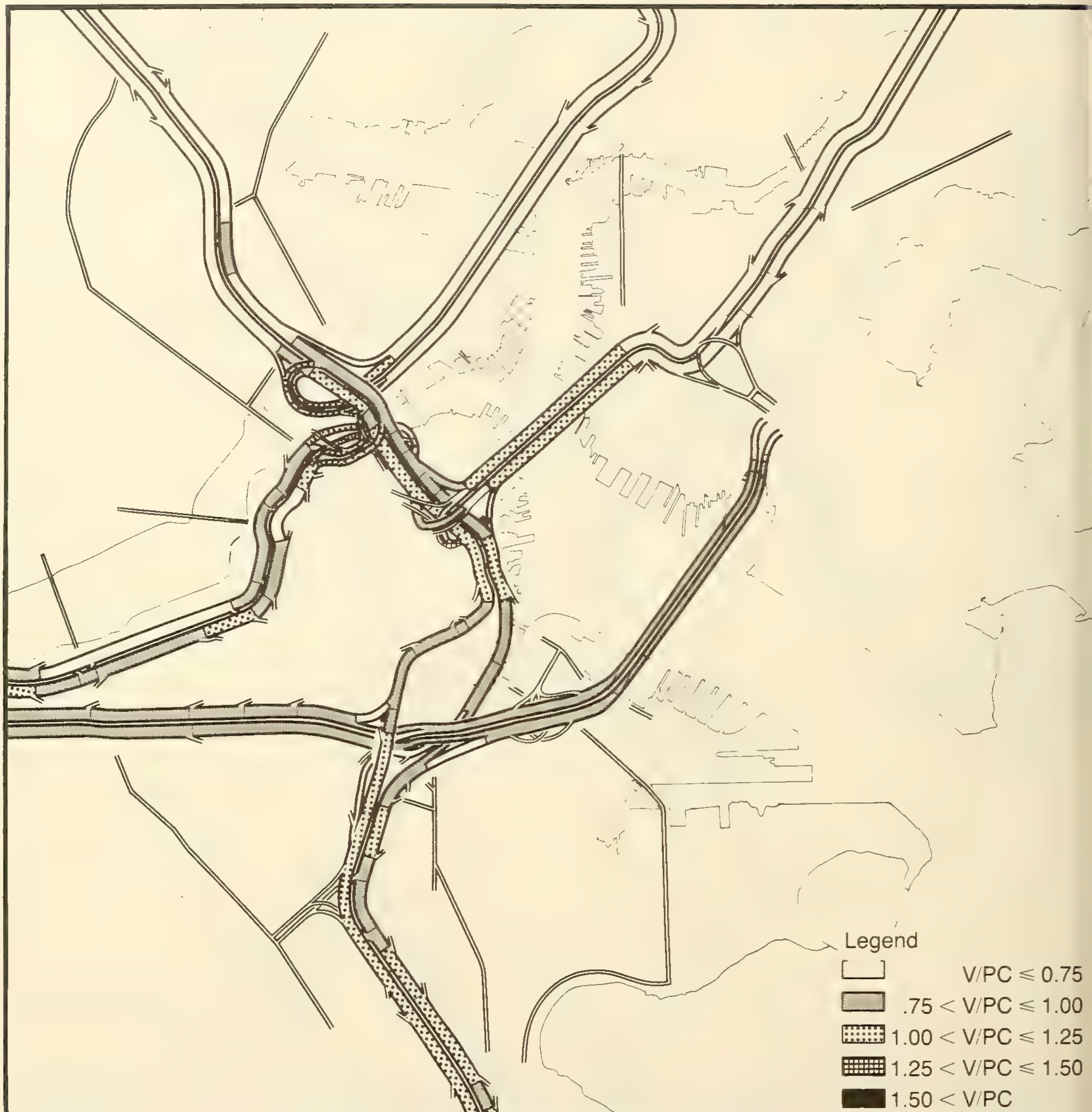


Figure 28

Two Lane Tunnel Concept – 1990 – Daily Volume Relative to Practical Capacity

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

Third Harbor Tunnel delays of four minutes would occur leading to the Southeast Expressway.

2.10 Two-Lane Tunnel Concept - Daily V/C, Queues, and Delays (1990)

The final option, the Two-Lane Tunnel Concept, is almost the same as the Preferred Alternative, except that it contains only one lane across the harbor in each direction and it does not have direct connections to Route 1A in East Boston. It goes only to Logan Airport.

Daily V/C statistics for this concept are shown in Figure 28. As may be seen in Figure 28, daily V/C statistics for this concept would not be as good as those of Alternative 3A or the Preferred Alternative. A number of segments of the Central Artery would have volumes that are between 1.00 and 1.25 times practical capacity, and the Sumner and Callahan Tunnels would both be between 1.00 and 1.25 times practical capacity. The reason for this is partly the restricted capacity of the Third Harbor Tunnel and partly the lack of access for Route 1A trips to the Third Harbor Tunnel. Because of this lack of access, the Third Harbor Tunnel itself would operate at between 0.75 and 1.00 times daily practical capacity.

The queue and delay implications of the daily V/C statistics are shown for the AM and PM peaks, respectively, in Figures 29 and 30. As might be expected, the AM peak queues and delays for the Two-Lane Tunnel Concept would be much the same as those of Alternative 3A and the Preferred Alternative, except for that of the Sumner Tunnel. The Sumner Tunnel delay in the Two-Lane Concept would be 5.4 minutes as compared with 1.3 minutes in Alternative 3A and the Preferred Alternative. All of the other AM queues in the Two-Lane Tunnel Concept would have about the same delays as those of Alternatives 3A and the Preferred Alternative, ranging from 3.5 minutes for the Southeast Expressway northbound to 1.0 minutes at the Third Harbor Tunnel toll booths going to the airport.

The PM peak would also reflect the inadequate Third Harbor Tunnel capacity and lack of Route 1A access from the Third Harbor Tunnel. In the Two-Lane Tunnel Concept, a northbound Central Artery queue would be created, with delays of 7.4 minutes leading to the Callahan Tunnel portal. Similarly, delays would be experienced leading to the Callahan Tunnel from the north. The Sumner Tunnel would also experience substantial queuing and delays: an average maximum PM peak queue stretching from the Central Artery almost to the Airport on-ramp, and encompassing delays of 8.3 minutes. The Third Harbor Tunnel itself would experience relatively small PM peak delays with this Concept: 1.0 minutes northbound and 0.5 minutes southbound at the toll booths. The other PM peak delays of this Concept are related to Leverett Circle and the Southeast Expressway, just as in the other alternatives. The Leverett Circle queue would stretch to beyond the Arlington Street off-ramp and would have delays of 7.1 minutes. The southbound Central Artery would have intermittent queuing leading into the Southeast Expressway, with delays of 7.6 minutes.

2.11 Summary: Vehicle Hours and Average Minutes of Delays in Queues

Two summary measures are readily available to compare the queuing and delay characteristics of the various alternatives. The first of these is average vehicle hours of delay in queues. These are calculated by multiplying the three-hour AM and PM link volumes in queues by the link delays in the queues, and summing over all queues, both AM and PM. The results of such calculations are presented in Table 2 for the eight alternatives for AM peak, PM peak, and peak periods combined for daily statistics. The table also presents annual statistics, assuming 260 work days per year.

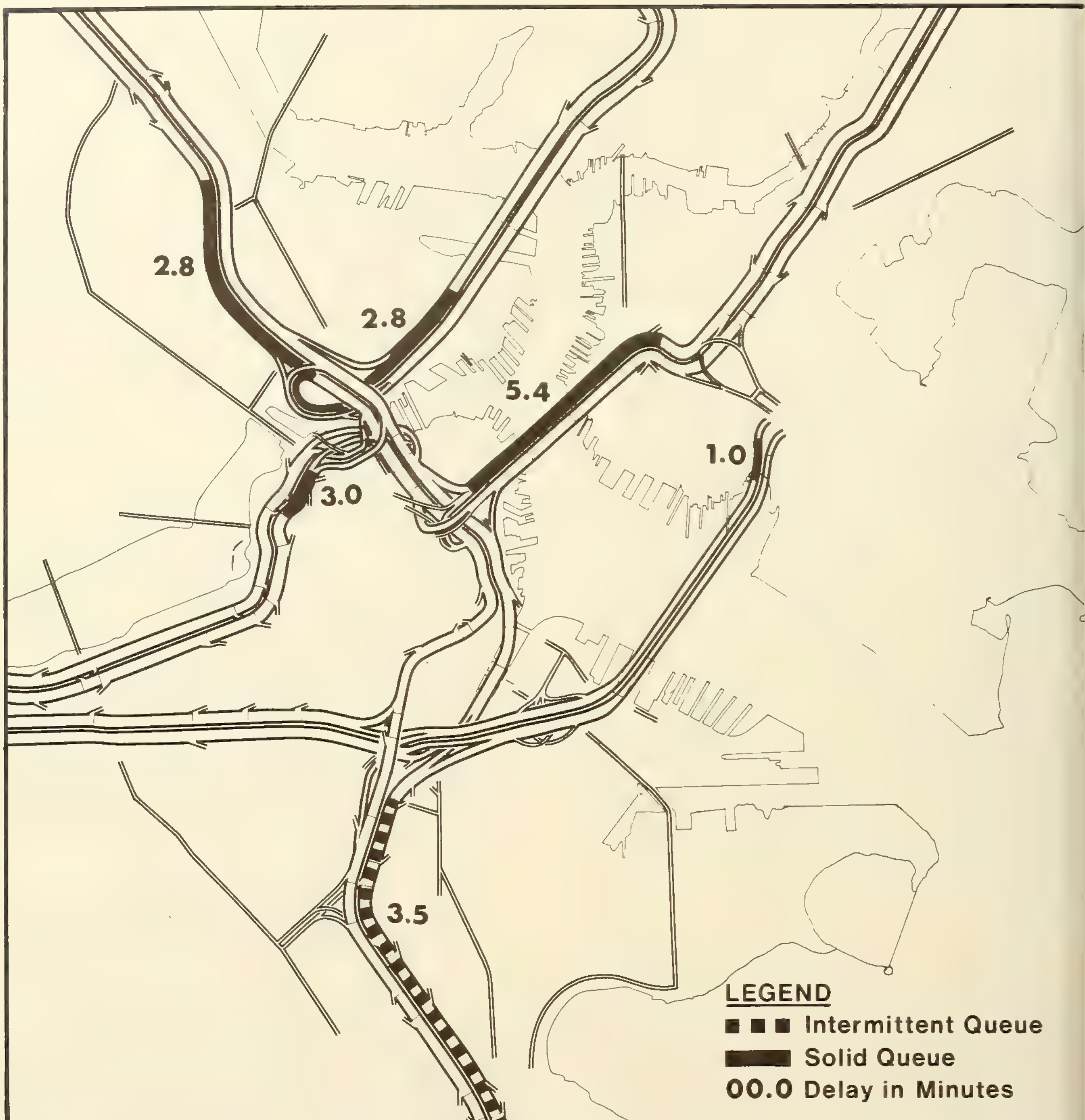


Figure 29

Two Lane Tunnel Concept – Mainline Queues and Delays–1990 A.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

Figure 30

Two Lane Tunnel Concept – Mainline Queues and Delays–1990 P.M. Peak

EIS/EIR for I-90–Third Harbor Tunnel; I-93–Central Artery

From the table, it may be seen that annual vehicle hours of delay in queues were about 3.5 million in 1977. This is expected to grow by about 38% to about 4.8 million annual hours of delays in queues by 1990 if the No-Build Alternative is adopted. If either the Central Artery Depression or the Third Harbor Tunnel is constructed, annual vehicle hours of delay by 1990 can be expected to be reduced to about 3.2 million, or about a 9% reduction from the 1977 total.

If both the Central Artery Depression and the Third Harbor Tunnel are constructed, annual vehicle hours of delays in queues will be reduced to about 2.1 million annual vehicle hours, almost a 40% reduction from the experience of 1977, and a 55% reduction from what would be experienced in the No-Build Alternative for 1990. Of this 2.1 annual million vehicle hours of delay, about half would relate to Leverett Circle and the Southeast Expressway, and not to Central Artery or harbor crossing capacity at all.

The two-lane Third Harbor Tunnel alternative would have annual vehicle hours of delay of 2.8 million. As might be expected, vehicle hours of delay for this option would be somewhat less than those of building a four-lane Third Harbor Tunnel alone or of building a Central Artery depression alone, but considerably more than those of building both a Central Artery depression and a four-lane Third Harbor Tunnel.

The second summary statistic is systemwide average queue delay per vehicle. Although this statistic is not very well-defined, it is a measure of average delay per vehicle attempting to go to and through downtown Boston. The statistic is created by multiplying typical vehicle volumes for each queue by the minutes of delay in each queue, and then adding the results to create vehicle hours for all the queues combined. These are then divided by the total typical hourly volumes of vehicles in the queues to yield average minutes : delay.

The results of this procedure are shown in Table 3 for the eight alternatives analyzed. Average dela are shown for the AM peak period, th PM peak period, and for a weighted average of the two. As may be seen the table, average queuing delays pe vehicle going to or through Boston were 5.6 minutes during the AM peak 1977 and 13.5 minutes during the PM peak. If the No-Build Alternative i adopted, these average delays can be expected to increase to 7.8 and 15.4 minutes, respectively (including the North Area Project).

If either a Central Artery Depression or a four-lane Third Harb Tunnel is constructed, average delay can be expected to drop to about 3.6 minutes in the morning peak and 9.7 minutes in the evening peak. If bot facilities are constructed, average vehicle delays will drop to about 2. minutes in the morning and 3.5 minut in the evening. A substantial porti of these delays will relate not to t Central Artery or the Third Harbor Tunnel, but to Leverett Circle and t Southeast Expressway.

Finally, if the Central Arter is depressed and a two-lane Third Harbor Tunnel is constructed, averag AM peak delays per vehicle will be 3 minutes and average PM peak delays will be 5.0 minutes. This is intermediate between the results of fully building one facility and full building both.

3.0 EFFECTS ON PUBLIC TRANSPORTAT

In response to a number of concerns raised during the EIS/EIR process of the project's effects on public transportation ridership, several extensive analyses have been performed. These analyses were performed for different purposes and different agencies, but overall tend to indicate that the Preferred Alternative will have an insignifica impact on transit ridership in the long term. Technical memoranda on t

following pages present the
documentation of these analyses.

Table 2

AVERAGE WEEKDAY AND ANNUAL VEHICLE HOURS OF DELAY: BASE CASE (1977), NO-BUILD ALTERNATIVE, ALTERNATIVES 3, 5, 6, 3A, PREFERRED ALTERNATIVE, AND TWO-LANE TUNNEL CONCEPT (1990)

Alternatives	Time Period	Daily Vehicle Hours of Delay	Annual Vehicle Hours of Delay
Base Case (1977)	AM Peak	5,236	
	PM Peak	8,125	
	Total	13,361	3,437,860
No-Build Alternative (1990)	AM Peak	7,251	
	PM Peak	11,227	
	Total	18,478	4,804,280
Alternative 3 (1990)	AM Peak	4,232	
	PM Peak	7,995	
	Total	12,227	3,179,020
Alternative 5 (1990)	AM Peak	4,020	
	PM Peak	8,063	
	Total	12,083	3,141,580
Alternative 6 (1990)	AM Peak	4,153	
	PM Peak	8,195	
	Total	12,348	3,210,480
Alternative 3A (1990)	AM Peak	3,419	
	PM Peak	4,833	
	Total	8,252	2,145,520
Preferred Alternative (1990)	AM Peak	3,693	
	PM Peak	4,712	
	Total	8,405	2,185,300
Two-Lane Tunnel (1990)	AM Peak	3,876	
	PM Peak	6,894	
	Total	10,770	2,800,200

Table 3

AVERAGE QUEUE DELAY PER VEHICLE: BASE CASE (1977), NO-BUILD ALTERNATIVE, ALTERNATIVES 3, 5, 6, 3A, PREFERRED ALTERNATIVE, AND TWO-LANE TUNNEL CONCEPT (1990)

Alternatives	Time Period	Average Queue Delay Per Vehicle (minutes)
Base Case (1977)	AM Peak	5.6
	PM Peak	13.5
	Total	4.0
No-Build Alternative (1990)	AM Peak	7.8
	PM Peak	15.4
	Total	11.3
Alternative 3 (1990)	AM Peak	3.7
	PM Peak	9.5
	Total	6.2
Alternative 5 (1990)	AM Peak	3.7
	PM Peak	9.5
	Total	6.2
Alternative 6 (1990)	AM Peak	3.5
	PM Peak	9.8
	Total	6.5
Alternative 3A (1990)	AM Peak	2.5
	PM Peak	4.4
	Total	3.4
Preferred Alternative (1990)	AM Peak	2.5
	PM Peak	4.5
	Total	3.5
Two-Lane Tunnel (1990)	AM Peak	3.2
	PM Peak	6.7
	Total	5.0

CTPS

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CENTRAL
TRANSPORTATION
PLANNING
STAFF

MEMORANDUM

TO: Third Harbor Crossing Files September 11, 1985

FROM: Mark Scannell MS

RE: Revised Estimation of Person Hours of Travel, Vehicle Hours of Travel and Vehicle Miles of Travel for the Central Artery/Third Harbor Crossing Final Environmental Impact Statement Alternatives

This memo documents changes in the values of three travel indices used in evaluating Central Artery/Third Harbor Crossing (CA/THC) alternatives. The indices are daily savings in person hours of travel (PHT), vehicle hours of travel (VHT) and vehicle miles of travel (VMT).

PHT savings measures the efficiency of an alternative relative to the no build scenario in terms of travel time experienced by a fixed number of vehicle users (persons). For the estimation of this index, the number of trips used includes those person trips induced by the tunnel component (Build Trip Table). Similarly, VHT and VMT savings measure the efficiency of a given alternative relative to the no build option in terms of the total travel time experienced and total distance travelled by all vehicles in the system. In estimating VHT and VMT savings, however, the number of vehicle trips is not fixed, with induced travel taking place only under those alternatives with a tunnel component.

Recently, the Massachusetts Executive Office of Transportation and Construction (EOTC) was given permission by the Federal Highway Administration (FHWA) to publish the CA/THC Final Environmental Impact Statement (FEIS). At this time, EOTC was also directed to correct any inconsistencies or inaccuracies identified subsequent to the report's original submission to FHWA in September of 1985. In response, CTPS has developed a revised set of CA/THC alternative PHT, VHT and VMT savings to be incorporated into the report. These revised figures along with the original FEIS values are presented in Tables 1, 2 and 3.

In order to understand why these changes have been made, a brief history of events leading up to the changes is in order. In September 1983, EOTC submitted a set of CA/THC alternative PHT, VHT amd VMT savings to FHWA for review as part of the project's FEIS. These savings were estimated for the CA/THC study area which includes the Boston urban core and the imme-

Cooperative Transportation Planning Effort of the Executive Office of Transportation and Construction Massachusetts Bay Transportation Authority MBTA Advisory Board Massachusetts Department of Public Works Massachusetts Port Authority Metropolitan Area Planning Council

Alternative	PHT Savings[1]	
	Initial 9/30/83 Estimate (hours)	Revised Estimate (hours)
3	5,725,000	8,200,000
3A	11,700,000	8,800,000
5	9,232,000	9,200,000
5A	14,784,000	13,000,000
5A7	20,632,000	17,600,000
6	2,659,000	1,800,000

[1]Daily study area values for the year 2010

CHANGE IN THE ESTIMATES OF
CA/THC ALTERNATIVE
PERSON HOURS OF TRAVEL
(PHT) SAVINGS

CTP

TABL

1

Alternative	VHT Savings [1]	
	Initial 9/30/83 Estimate (hours)	Revised Estimate (hours)
2	100,000	560,000
3	100,000	1, 714,000
3A	4,400,000	2,090,000
4	2,600,000	1,510,000
5	2,600,000	2,403,000
5A	6,600,000	5,970,000
5A7	20,600,000	9,164,000
6	1,900,000	-850,000

[1] Daily study area values for the year 2010

CHANGE IN THE ESTIMATES OF CA/THC ALTERNATIVE VEHICLE HOURS OF TRAVEL (VHT) SAVINGS

CTPS

TABLE 2

Alternative	VMT Savings[1]	
	Initial 9/30/83 Estimate (miles)	Revised Estimate (miles)
2	19,000,000	-19,900,000
3	19,000,000	-20,800,000
3A	41,000,000	-32,300,000
4	27,000,000	-18,600,000
5	27,000,000	-27,300,000
5A	39,000,000	-36,000,000
5A7	105,000,000	-17,700,000
6	59,000,000	-15,000,000

[1]Daily study area values for the year 2010

CHANGE IN THE ESTIMATES OF
CA/THC ALTERNATIVE
VEHICLE MILES OF TRAVEL
(VMT) SAVINGS

CTPS

TABLE
3

diately adjacent areas. PHT and VHT savings were calculated using the regression method as documented in a January 17, 1984 CTPS memo titled, "Determination of Vehicles Hours of Travel for the Central Artery/Third Harbor Crossing Alternatives", with PHT being related to the corresponding VHT by a vehicle occupancy factor of 1.46. The VMT savings were calculated by simple subtraction using values taken directly from the computer printouts. These methods are consistent with those employed in the Supplemental Draft Environmental Impact Statement of June 1983.

During the latter part of 1984 and the early part of 1985, CTPS carried out, with the help of FHWA, a re-evaluation of the methods employed in estimating PHT, VHT and VMT. During this review, several problems were identified. The first such problem was the distortion of PHT and VHT savings as estimated by the regression method. This distortion was caused by a rounding error inherent in the reporting of UTPS assignment statistics. The second problem, one common to the estimation of all three indices was the coding of certain alternatives with area types outside of the study area, resulting in the underreporting of study area PHT, VHT and VMT values. The third problem, also common to the calculation of all three indices, was the underestimation of savings for those alternatives with a seaport access interchange. The problem was caused by the existence of an independently proposed seaport access facility in the no build option.

During the summer of 1985, CTPS developed the revised set of PHT, VHT and VMT savings, correcting for these problems. This memo continues with a detailed discussion of each problem area and the solutions that were developed.

<u>Distortion of Study Area VHT due to UTPS Rounding Error</u>

As part of the regression method of VHT estimation, a factor is developed for the purpose of scaling converged full network VHT down to the study area level (see table 4). The calculation of this factor is subject to distortion since it is based, in part, on area type speed values, each of which is rounded to the nearest mile per hour in Report 6 of UROAD. The sensitivity of study area VHT to the rounding of these speed values is best described by an example. Under Alternative 5A13, a rounding error of .25 miles per hour in area type 2 (23.75 mph reported as 24 mph) would distort annual study area VHT by 640,000 hours. The uncertainty introduced by this rounding error is considered unacceptable, since the error is of the same order of magnitude as the savings.

To correct this problem, a method has been developed whereby the ratio of study area to full network VHT can be calculated independent of the UROAD summary statistics . For this purpose, the CTPS-developed UTPS Diagnostic Package is used to create a file containing volume, distance, congested

Step 1 Determine non-converged VHT for each area type based on assignment statistics as presented in Report 6 of UROAD.

Area Type	VHT Calculation		
---	$\frac{\text{VMT (miles)}}{\text{SPEED (miles/hr)}}$	=	VHT (hours)
1	$\frac{1956400 \text{ miles}}{19 \text{ mi/hr}}$	=	102968 hours
2	$\frac{7497600 \text{ miles}}{24 \text{ mi/hr}}$	=	312400 hours
3	$\frac{15358300 \text{ miles}}{28 \text{ mi/hr}}$	=	548510 hours
4	$\frac{1056900 \text{ miles}}{19 \text{ mi/hr}}$	=	55626 hours
5	$\frac{367100 \text{ miles}}{34 \text{ mi/hr}}$	=	10797 hours

Total Network VHT = 1,030,301 hours

Step 2 Determine the study area percent share of full network non-converged VHT. Study area is made up of area types 1 and 2.

$$\frac{\text{Areas 1 \& 2 VHT}}{\text{Full Network VHT}} = \frac{102968 + 312400 \text{ hrs.}}{1{,}030{,}301 \text{ hrs.}} = .403152$$

Source: Mark Scannell, "Determination of Vehicle Hours of Travel for the Central Artery/Third Harbor Crossing Alternatives", January 17, 1984

CALCULATION OF FULL NETWORK TO STUDY AREA SCALING FACTOR

CTPS

TABLE 4

speed and area type for each link in the network. Using these data, non-converged VHT for the entire network is calclulated by the following formula:

$$VHT = \sum_{1}^{L} V \times \frac{D}{S}$$

where V = link volume
D = link distance
S = link congested speed

To calculate study area non-converged VHT, the file is sorted by area type, isolating study area links (Area Types 1 and 2). The above calculation is then carried out for Area Type 1 and 2 links to determined the study area VHT value. A simple division of this study area value by the corresponding full network value yields a corrected VHT scaling factor, free from the effect of UTPS rounding error.

<u>Coding of Links in Certain Alternatives with Area Types Outside of the Study Area</u>

During the coding of certain alternatives a number of project links located in the study area (Area Types 1 and 2) were coded with a non study area designation (Area Type 5). As a result, the PHT, VHT and VMT attributable to these links were not reported in study area assignment statistics giving the inappropriate appearance of additional project savings.

The decision to code links in this manner was based on a desire to have network speeds and capacities as close to the actual design numbers in order to produce the best possible assigned traffic volumes. A link's speed and capacity is determined from lookup tables similar to that presented in Figure 1. Using a link's coded area type, facility type and number of lanes as keys, the UROAD algorithm can locate the desired speed/capacity entry. The attempt to replicate the design numbers as closely as possible required the use of a wide range of speed/capacity combinations. As the networks for alternatatives were developed, it was discovered that the Area Type 1 and 2 lookup tables could no longer accommodate the needed speed/capacity combinations. At this time a decision was made to use the largely unused Area Type 5 cells in order to continue accurate coding. As a result, there exist a number alternatives with links physically located in Area Type 1 but coded as Area Type 5.

A R E A   T Y P E   1

LANES		FACILITY TYPE 1	2	3	4	5	6
1	CAPACITY	1750.	813.	600.	700.	99999.	50000.
	SPEED	48.0	40.0	15.0	15.0	15.0	60.0
2	CAPACITY	3500.	813.	333.	330.	300.	375.
	SPEED	50.0	40.0	15.0	15.0	15.0	20.0
3	CAPACITY	2533.	813.	333.	330.	300.	375.
	SPEED	50.0	40.0	15.0	15.0	15.0	20.0
4	CAPACITY	1900.	925.	333.	330.	300.	375.
	SPEED	50.0	45.0	15.0	15.0	15.0	20.0
5	CAPACITY	1050.	900.	333.	330.	300.	375.
	SPEED	55.0	45.0	15.0	15.0	15.0	20.0
6	CAPACITY	808.	800.	333.	330.	300.	375.
	SPEED	55.0	45.0	15.0	15.0	15.0	20.0
7	CAPACITY	814.	714.	333.	330.	10000.	375.
	SPEED	50.0	48.0	15.0	15.0	15.0	20.0
8	CAPACITY	750.	714.	600.	700.	10000.	350.
	SPEED	55.0	45.0	15.0	15.0	15.0	20.0
9	CAPACITY	750.	714.	600.	700.	10000.	152.
	SPEED	55.0	45.0	15.0	15.0	15.0	20.0

SPEED/CAPACITY LOOKUP TABLE

CTPS

FIGURE

1

The solution to this problem was fairly straightforeward. With the reported Area Type 5 PHT, VHT and VMT values known for the no build scenario, it was assumed that the differences between these and the corresponding numbers reported for the CA/THC alternatives were the result of study area links coded with the non study area designation. These differences were added to the reported study area totals to produce corrected values.

Understating of Savings from the CA/THC Seaport Access Component

During the reassessment of the estimation procedures, it was realized that PHT, VHT and PHT savings for alternatives that include a seaport access interchange were underestimated due to the fact that an independently proposed seaport access facility was included in the no build scenario. This being the case, the seaport access alternatives were only credited with their incremental increases in these savings beyond that associated with the no build seaport access road. In order to credit these alternatives with their full seaport access related savings, they were evaluated against a modified No Build (Alt. 1.1), one which does not include the competing seaport access road. All other non-seaport access alternatives continued to be evaluated against the unmodified No Build since they, themselves, include the independent seaport access road.

Conclusion

Much time and effort has gone into the refining of the PHT, VHT and VMT savings reported in the FEIR. These indices offer an indication of the relative merit of the various alternatives. Caution should be used in interpreting these results since they are still affected by a certain level of assignment related jumpiness that cannot, with the methods presently available, be corrected. For this reason, the reported savings should be used as general indicators with more emphasis placed on trends rather than specific numbers or differences.

MS:klf
23103

MEMORANDUM

TO : Rodney P. Plourde April 30, 1984

FROM : Gary L. Hebert GH

SUBJECT : Synopsis of Technical Documentation for the Depressed Central Artery/Third Harbor Tunnel Preferred Alternative's Impacts on Public Transportation Usage and Induced Traffic

In response to a review comment by the Executive Office of Environmental Affairs on the SDEIS/SDEIR for the Depressed Central Artery/Third Harbor Tunnel Project, this memo has been prepared to summarize the impacts the Preferred Alternative will have on public transportation usage in the Boston Metropolitan area compared to the No-Build Alternative. Analyses of public transportation impacts were performed by Central Transportation Planning Staff (CTPS) and Cambridge Systematics Incorporated (CSI). CSI studies focused on Logan Airport public transportation impacts, while CTPS performed separate studies of Logan Airport and regional public transportation impacts.

General conclusions of these studies are as follows:

1) CSI has concluded that when implemented in conjunction with improved public transportation bus service improvements, the Preferred Alternative is expected to increase Logan Airport public transportation usage (including MBTA and private limousine carriers) by about 20 percent (+1070 one-way person trips). Currently, there are about 33,700 people travelling to and from Logan Airport on a typical weekday. Of these, 15.6 percent use public transportation (i.e., the Blue Line/Massport shuttle bus service/airport limousine services)) to access Logan Airport. The Preferred Alternative highway improvements coupled with the new bus ramps and improved public transportation services will increase public transportation's share of airport trips to 18.6 percent. The Commonwealth of Massachusetts is committed to implementing the improved transit services made possible by the implementation of the Preferred Alternative.

2) CTPS has concluded that regional transit usage, excluding Logan Airport transit trips which were analyzed separately, is expected to decrease by less than one percent with the Preferred Alternative (-1260 one-way person trips). Currently, there are about 217,000 AM peak period transit trips being made on the MBTA to/from and through downtown Boston on a typical weekday. Such a small ridership reduction (-0.6 percent) is considered to be statistically insignificant since, for example, MBTA transit ridership in the most recent twelve month reporting period is growing at a rate of 8 percent annually.

3) The overall impact on Logan and regional public transportation impacts is a slight loss of less than one percent in the worst case (i.e., no transit service improvements) and much less than one percent with the transit improvements proposed to complement the Preferred Alternative.

These conclusions are summarized in Sections 1.3 and 4.2 of the Final Environmental Impact Statement/Final Environmental Impact Report (FEIS/FEIR). The technical documentation data for the FEIS/FEIR conclusions pertaining to public transportation and induced traffic are contained in eleven separate memos (see attachments) prepared by CTPS and CSI.

Taken individually, minor inconsistencies can be found between the CTPS and CSI memos. These inconsistencies occurred because CTPS and CSI approached the issue of Logan Airport public transportation impacts from two entirely different perspectives. CTPS developed travel forecasts for the Depressed Central Artery/Third Harbor Tunnel Project for the Massachusetts Department of Public Works. CSI performed evaluations of various strategies to improve the usage of various public transportation modes of travel to Logan Airport for Massport. They initiated and performed their studies at different times using completely different computer models (each of which uses highly sophisticated "state-of-the-art" technology) and were engaged to perform different tasks. Each employed their own sets of assumptions and used slightly different data that applied to different base years.

Taken collectively, the results of their independent analyses are, however, quite consistent. In reverse chronological order, the subjects and contents of each of these memos are summarized below.

1) April 27, 1984: Impact of the Central Artery/Third Harbor Crossing Improvement on Public Transit Ridership: Recap. of September 23, 1983, Memo by Yong Chang and Tom Lisco (CTPS). Builds upon CTPS's November 15, 1983 memo by constraining downtown Boston's parking supply according to the current U. S. Environmental Protection Agency-imposed downtown Boston parking freeze. With the Preferred Alternative and parking "capped" in downtown Boston, CTPS concluded that regional MBTA transit losses will be 1260 one-way trips on a typical weekday.

2) March 30, 1984: Summary of Analysis of Third Harbor Crossing Access Impacts (CSI). Summarizes the percentages of mode shifts for Logan Airport access under the preferred alternative with and without bus transit and airport limousine service frequency improvements. CSI concluded that public transportation's share of Logan Airport access will increase by about 20 percent with both the airport shuttle service and increased bus and airport limousine frequencies.

3) March 21, 1984: Difference Between Build and No-Build Forecasts, Logan Airport 2010 AWDT (CTPS). Contains a summary of the technical reasons why 12,800 additional vehicle trips -- brought about by persons shifting from higher occupancy vehicles (i.e., carpools, buses, rapid transit, etc.) to lower occupancy vehicles (i.e., one or two occupant automobiles) or "modal shifts" -- are expected in the year 2010 with build alternatives that feature a Third Harbor Tunnel. Conclusions are based on CTPS's May 24, 1982 memo cited below.

4) March 20, 1984: Analysis of Airport Access Mode Change with Shuttle Bus from South Station, via New Third Harbor Crossing, including improved highway times (CSI). Contains an analysis of the differences between Logan Airport base case condition "modal splits" (i.e., the share of airport-related travel by mode -- including MBTA services, automobile,

rental car, taxi, private express bus and airport limousine -- assuming a constant 1981 Logan Airport travel demand) and the modal splits that woul occur by 1) Providing new airport-oriented MBTA shuttle bus services from South Station; or 2) Increasing bus and airport limousine frequencies in addition to the shuttle bus services. Improved travel times for other modes of travel were assumed and the MBTA Alewife Red Line Extension was assumed to be in operation. CSI concluded that, with the Preferred Alternative, public transportation use by Logan Airport travellers (currently at 6.6 percent of all Airport trips) would increase by 12 percent (about 270 round person trips) with shuttle bus services alone (bringing public transportation's share of Airport trips to about 8 percent). CSI also concluded that with increased private express bus and airport limousine frequencies, as well as new MBTA shuttle bus services, combined MBTA/private express bus and airport limousine ridership would increase by 20 percent (about 1,070 round person trips).

5) <u>March 5, 1984: Analysis of Airport Access Mode Change with Shuttle Bus from South Station, via New Third Harbor Crossing (CSI)</u>. Superseded by CSI's March 20, 1984 memo, this memo contains an analysis of the difference between Logan Airport base case condition modal splits and modal splits that will occur by providing new airport-oriented MBTA shuttle bus services from South Station (assumes constant 1981 Logan Airport Travel demand). The memo was superseded because it did not assume any travel time benefits to other modes of travel and, consequently, overstated expected public transportation usage with the proposed MBTA shuttle bus services.

6) <u>November 15, 1983: Mode Choice Impacts of the Central Artery Depression/ Third Harbor Crossing on Travel to and Through Downtown Boston for the AM Peak Period (CTPS)</u>. Contains a summary of modal split differences during the 7 to 10 AM peak period between base conditions (assuming constant 198[illegible] public transportation demand and unconstrained downtown Boston parking supply) and conditions which would occur due to modal shifts to and through downtown Boston with the Preferred Alternative's highway improvements but <u>without</u> a downtown Boston parking cap -- i.e., parking will be available to accommodate automobiles created by transit patron diversions. This memo builds upon CTPS's September 23, 1983 memo (Number 7 below) which summarized public transportation person trip modal shifts during the same 7 to 10 AM peak period with the Preferred Alternative's highway improvements. For the region, CTPS concluded that, without a continuation of the current downtown Boston parking freeze, public transit travel to downtown Boston during the AM peak period would drop by 2 percent; public transportation travel through Downtown during the AM peak period would drop by 1 percent with similar increase in highway travel. The expected increase in highway travel is so small that it does not change the accuracy of the model results as presented in the FEIS/FEIR. The April 27, 1984 CTPS memo builds upon this memo by discussing the transit diversion impacts with the Preferred Alternative under the assumption that the current downtown Boston parking freeze, rather than unconstrained parking, is maintained.

7) <u>September 23, 1983: Impact of the Central Artery/Third Harbor Crossing Improvement on Public Transit Ridership (CTPS)</u>. Contains a summary of inbound public transportation person-trip modal shifts during a typical weekday with the Preferred Alternative's highway improvements. For the

region, it was concluded that, with a 1982 data base, the 7 to 10 AM peak period public transit inbound person trips to and through downtown Boston would drop by about 3,100 (from a base of about 217,000 regional public transportation trips that occur during the 7 to 10 AM peak period to or through downtown Boston under an assumption of unconstrained downtown Boston parking) without a Southeast Expressway contraflow bus lane included as a mitigating measure of the Depressed Central Artery/Third Harbor Crossing Project and with unconstrained available parking in downtown Boston. With the contraflow bus ramps, the drop is 2,800 person trips. The April 27, 1984 CTPS memo supersedes this memo by adjusting the anticipated transit ridership losses to take into account the expected continuation of the existing downtown Boston parking freeze.

8) <u>September 23, 1983: Induced and Converted Traffic AWDT (CTPS).</u> Contains a summary of a comprehensive national literature search on the subjects of induced (or "new") traffic and converted (or "modal shift") traffic (as described in the other CTPS memos) due to new and improved highway facilities. CTPS concluded that there is not enough information to quantify accurately the combination of induced and converted traffic due to the Preferred Alternative's highway improvements. Furthermore, CTPS concluded that whatever induced or converted traffic occurs, it would be significantly less than the volume of traffic expected for the new Third Harbor Tunnel.

9) <u>May 28, 1982: Access Mode Impacts of Transit Service Improvements (CSI).</u> Contains an analysis of the difference between Logan Airport base case condition public transportation usage (assuming constant 1981 Logan Airport travel demand) and the public transportation usage that will occur by providing various combinations of programmed and theoretical public transportation changes (e.g., the Red Line extension to Alewife Brook Parkway set to open in early 1985 and a theoretical Blue Line Airport spur extensions), automobile delay assumptions, and mode transfer penalties. CSI concluded that public transportation's 6.6 percent share of total airport trips could increase to 8.6 percent, at best, with massive public transportation expenditures. CSI also concluded that degrading highway travel times and reducing the modal transfer penalties will increase public transportation usage more substantially than high-capital public transportation improvements alone. With the most optimistic conditions, that is with massive public transportation expenditures, the lowest transfer/wait penalties, and most severe automobile delays, public transportation could only expect a 13.6 percent share of total inbound airport trips (about 33,700 trips in 1981).

10) <u>May 24, 1982: Logan Airport Ground Traffic in the Year 2010: Three Scenarios (CTPS).</u> Contains the original analyses conducted regarding the 12,800 additional vehicle trips assumed for build alternatives with a Third Harbor Tunnel. CTPS cautions that there is a low degree of accuracy involved with guessing about traffic conditions which will occur 28 years. The analyses performed had 34 basic assumptions, each of which has its own "error properties".

11) August 26, 1981: Pilot Analysis of Airport Passenger/Companion Access Alternatives (CSI). Contains the description of the CSI computer model used to analyze the sensitivity of existing Logan Airport travel modes (in CSI memos cited above) to various public transportation and highway changes.

GH:gh
Ref. UH-004 G-540
cc: William J. Oliver, MDPW
Matthew Coogan, EOTC
Barry Faulkner, CSI
Arnold Soolman, CTPS

By Hand MB

RPT
DLG
RK
KUK
SCY
GLH

CTPS

central transportation planning staff
10 park plaza room 2150 boston, ma. 02116-3968 (617) 973-7100

MEMORANDUM

TO: Third Harbor Crossing File April 27, 1984

FROM: Yong B. Chang YC

RE: Impact of the Central Artery/Third Harbor Crossing Improvement on Public Transit Ridership: Recap. of September 23, 1983, Memo by Yong Chang and Tom Lisco

The September 23 Memo summarized the analysis results as follows:

> "In sum, the Central Artery/Third Harbor Crossing Project can be expected to divert approximately 3,100 trips from the transit system. Since most of these trips will be to downtown, this translates into approximately 2,200 additional automobile trips (assuming an average auto occupancy of 1.4). Whether the total change takes place will depend to a considerable degree on whether the 2,200 extra parking places are provided in downtown Boston"

According to a recent parking study (Efficient Operation of Off-Street Parking in Boston, BRA, January 1984), there were approximately 31,800 off-street parking spaces in downtown Boston and 93% of them were occupied at noon time in 1982. In terms of parking spaces, 29,500 were occupied and the remaining 2,300 were available.

Utilization of these downtown parking spaces will increase over time and it is reasonable to assume that the increase in parking utilization will be in direct proportion to the increase in downtown employment. The employment in downtown Boston has been projected to increase by 4.5 percent over the next ten years by the MAPC (Employment Location in Greater Boston, 1970-2010, MAPC, July 1983).

Using the MAPC's projection, parking utilization will increase from 29,500 to 31,800 spaces and only 900 spaces will be available to those who would shift from the transit system in 1980. These 900 spaces correspond to 1,260 passenger trips.

To sum up, the Central Artery/Third Harbor Crossing Project can be expected to divert approximately 1,260 trips from the transit system, in contrast with the earlier estimate of 3,100.

A Cooperative Transportation Planning Effort of the Metropolitan Area Planning Council
Executive Office of Transportation and Construction / Massachusetts Department of Public Works
Massachusetts Bay Transportation Authority / MBTA Advisory Board / and Massachusetts Port Authority

MEMO TO: Matthew A. Coogan, EOTC
Norm Faramelli, Massport

FROM: Barry Faulkner, Cambridge Systematics

DATE: March 30, 1984

RE: Summary of analysis of Third Harbor Crossing access impacts

---

Previous memoranda, dated March 5, 1984 and March 20, 1984, presented the results of analyses of the impacts of various transportation improvements on access mode choice for Logan air passengers. These analyses utilized a demand model developed by CS for Massport several years ago.

The analysis looked at the impacts of a new shuttle bus from South Station to the Logan terminals, with and without consideration of improved highway access times. Other analysis looked at the impacts of constraints on parking supply at the airport, and improvements in the express bus and limosine service to Logan.

The present memorandum summarizes the previous analysis in a somewhat different format. Each action is treated as though it occurs in sequence, with a cumulative impact on mode choice. These impacts are derived from the percentage change in mode use from the previous analysis. Separate model runs for each sequential step were not run. To the extent that these actions are not independent of each other, this method does not produce a perfect representation of the demand model, but it is believed that the results are reasonably close.

Table 1 presents the results of this analysis.

Table 1
Summary of Logan Access Analysis

	Action	MBTA Share*	Limo Share**
	Base Case modal shares	6.63%	8.92%
1	Improvement in highway times resulting from Central Artery and 3rd Harbor Crossing	-6.8%	+0.3%
	New modal shares	6.18%	8.95%
2	Addition of shuttle bus from South Station to airport terminals	+20.4%	-1.5%
	New modal shares	7.44%	8.81%
		u 12%	
3	Improvements in bus and limo service	-2.3%	+28.8%
	New modal shares	7.27%	11.35%
4	Parking constraints (9 percent below unconstrained demand)	+1.9%	+2.8%
	New modal shares	7.41%	11.67%
		up 12%	

* MBTA includes Massport shuttle bus from Airport Station or South Station.

* Limo includes all private bus/limosine service which operates directly to the airport.

TOTAL TRANSIT UP BY 20%

CTPS

central transportation planning staff

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MEMORANDUM

TO: Third Harbor Crossing File April 27, 1984

FROM: Yong B. Chang

RE: Impact of the Central Artery/Third Harbor Crossing Improvement on Public Transit Ridership: Recap. of September 23, 1983, Memo by Yong Chang and Tom Lisco

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Using the MAPC's projection, parking utilization will increase from 29,500 to 31,800 spaces and only 900 spaces will be available to those who would shift from the transit system in 1980. These 900 spaces correspond to 1,260 passenger trips.

To sum up, the Central Artery/Third Harbor Crossing Project can be expected to divert approximately 1,260 trips from the transit system, in contrast with the earlier estimate of 3,100.

CTPS

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MEMORANDUM

TO : Third Harbor Crossing Files March 21, 1984

FROM: Cathy Buckley Cathy Buckley

SUBJ: Difference Between Build and No-Build Forecasts, Logan Airport 2010 AWDT

Estimates were made in 1982 of the number of vehicle-trips that would be generated by Logan Airport, with or without a new tunnel.[1] These estimates, done using manual techniques, were then incorporated into the build and no-build trip tables. Corresponding estimates were made for 1990.

It was estimated that, with a new tunnel, Logan Airport would generate one-way average weekday traffic (AWDT) in 2010 of 57,900 trips.[2] The corresponding estimate without a new tunnel was 51,509 trips.[3] The two-way difference between the Build and No-Build estimates was therefore 57,900 minus 51,509, times two, or about 12,800 trips.

These 12,800 vehicle-trips are an estimate of how many more vehicle-trips would be generated by Logan Airport if a new tunnel were to be built. There apparently has been some confusion as to how many of these 12,800 vehicle-trips would be made by people who, without a new tunnel, would have used transit. An estimate of that number was provided to the Executive Office of Transportation and Construction (EOTC) in the recent past. This memorandum, which has subsequently been requested by EOTC, explains how that estimate was developed. Although a series of memoranda was written to document Logan-related travel, the only item directly referenced here is the May 24th document cited above.

Total Traffic

Traffic to and from Logan was put into four major categories. The following table shows the one-way 2010 AWDT, for the build and no-build options, for those four categories:

Category	2010, One-Way AWDT Build[4]	No-Build[5]	Difference
Passengers	41,616	37,457	4,159
Employees	12,973	10,741	2,232
Air Cargo	2,230	2,230	-0-
Bird Island Flats	1,081	1,081	-0-
TOTAL	57,900	51,509	6,391

TABLE 1: Categories of Logan-Related Traffic, 2010 One-Way AWD
Build and No-Build

As can be seen, the difference in build and no-build options wa attributed to passenger and employee activities, not to air car or Bird Island Flats.

Passenger Activity

It was estimated that on a typical weekday in 2010, 30,940 air passengers would arrive at Logan by ground transportation.[6] The following table indicates person-trips and vehicle-trips by mode, for the build and no-build estimates for the year 2010.

Mode	Build Person-trips	Build One-way AWDT	No-Build[19] Person-trips	No-Build[19] One-wa AWD
Private Car				
parked	6,160[7]	5,357[8]	5,755	4,427
driven-away	10,671[7]	18,558[8]	8,632	14,387
visitors only	-0-	750[9]	-0-	750
Rental Car	3,496[10]	3,040[11]	3,837	2,952
Limousine	1,578[12]	438[13]	2,351	588
Taxi	6,064[14]	8,195[15]	6,683	9,031
Rapid Transit	1,949[16]	-0-	2,135	-0-
Other Bus	1,021[17]	105[18]	1,547	145
TOTAL	30,939	36,443	30,940	32,280

TABLE 2: Passenger-Related Logan Airport Traffic, 2010, Build and No-Build, Person-Trips and One-Way AWDT, By Mode

The only component of passenger-related traffic not included in Table 2 is "non-cargo truck" traffic. These truck entries, made specifically to service air passengers, were assumed to be the same for the Build and No-Build cases (a 2010 one-way AWDT of 5,177).[20]

The details of how the above were estimated are in the May 24, 1982, memorandum. In a few words, the "Build" scenario is a extrapolation of 1979 mode-share and vehicle-occupancy rates, as determined in a survey that year. The "No-Build" scenario is a modified mode-share, with increased ride-sharing and public transportation use, based on airport user surveys in 1970 and 1979.

Employee Activity

Similar assumptions were made concerning employee activities. The results of those assumptions, for the Build and No-Build cases in the year 2010, are indicated below. It was estimated that on a typical weekday in the year 2010, 10,868 people would be working at Logan Airport.[21]

	Build		No-Build	
Mode	Person-trips	One-way AWDT	Person-trips	One-Way AWDT
Private Car				
drive	8,836[22]	8,836[22]	7,064[30]	7,064[30]
passenger drop-off	259[23]	472[24]	373[30]	622[30]
carpool	480[25]	-0-	1,996[29]	-0-
Transit	902[26]	-0-	989[31]	-0-
Walk	43[26]	-0-	65[31]	-0-
Taxi	33[26]	42[27]	33[31]	42[31]
Motorcycle	109[26]	91[28]	163[31]	136[31]
Other	185[26]	92[29]	185[31]	92[31]
	10,847	9,533	10,868	7,956
Mid-day trips[32]		3,337		2,785
TOTAL		12,870		10,741

TABLE 3: Employee-Related Logan Airport Traffic, 2010, Build and No-Build, Person-Trips and One-Way AWDT, By Mode

Summary

The following table indicates the difference between the 2010 Build and No-Build cases in terms of mode split, for air passengers and employees combined.

Mode	Build Person-Trips	Build One-Way AWDT	No-Build Person-Trips	No-Build One-Way AWDT	Build Minus No-Build Difference Person-Trips	Build Minus No-Build Difference One-Way AWDT
Private Car						
parked[33]	15,476	14,193	14,815	11,491	+661	+2,702
driven away[34]	10,930	19,030	9,005	15,009	+1,925	+4,021
visitors only	-0-	750	-0-	750	--	--
Rental Car[35]	3,496	3,040	3,837	2,952	-341	+88
Limousine[35]	1,578	438	2,351	588	-773	-150
Taxi[36]	6,097	8,237	6,716	9,073	-619	-836
Rapid Transit[36]	2,851	-0-	3,124	-0-	-273	--
Other Bus[35]	1,021	105	1,547	145	-526	-40
Motorcycle[37]	109	91	163	136	-54	-45
Walk[37]	43	-0-	65	-0-	-22	--
Other[37]	185	92	185	92	--	--
Employee Mid-day[37]	--	3,337	--	2,785	--	+552
TOTAL	41,786	49,313	41,808	43,021	-22	+6,292

TABLE 4: Differences Between Build and No-Build Logan-Related Trips, 2010, Person-Trips and One-Way AWDT, By Mode

In terms of person-trips, the two major differences between .he Build and No-Build estimates are that in the Build case, over .,900 more people would be dropped off at the airport and 650 iore would park. In the No-Build case, these approximately 2,600 .re estimated instead to use limousines (770), taxis (620), other uses (530), rental cars (340), rapid transit (270), motorcycles 50), plus a few more who would walk (20). Most notably, the ncreased congestion in the No-Build case is estimated to liscourage people from driving to the airport to drop off air .ravelers or employees.

In terms of traffic, the Build scenario AWDT estimate is .bout 6,300 one-way trips higher than the No-Build case. Almost .wo-thirds of that increase is estimated to be due to the ncreased number of passengers and employees who are dropped off y someone who then drives away (4,020 trips). The other major ategory is an increase in passengers and employees who drive to ogan and park (2,700 trips, or over 40 percent of the total lifference). The only other categories that are estimated to ncrease trip-making are more mid-day employee trips (550) and iore rental car trips (90). The other categories all are estiated to have fewer trips in the Build case: taxis (-840), imousines (-150), motorcycles (-45), and other bus (-40).

If public transportation is defined as rapid transit, other us and limousines, then a new tunnel is estimated to remove .bout 1,570 people from public transportation to the airport on a .ypical weekday in 2010. Of these, 270 would be removed from apid transit (or, 540 two-way trips daily).

It is worthwhile to repeat a caveat from the May 24, 1982, iemorandum. These estimates are based on thirty-four assump-.ions, each of which has its own potential error properties.[38] 'he information in the tables above, although numerically pre-:ise, simply reflects an attempt to forecast human behavior over quarter-of-a-century from now. That attempt is based on human ehavior as found thirty-one and forty years (1979 and 1970) pre-rious to the forecast year of 2010.

:B/mh

Footnotes

1. C. Buckley, "Logan Airport Ground Traffic in the Year 2010: Three Scenarios," CTPS Memorandum, May 24, 1982.

2. Ibid., p.2.

3. Ibid., p. 10.

4. Ibid., p. 2.

5. Ibid., p. 10.

6. Ibid., p. 6.

7. Ibid., pp. 3 and 5. This is the total number of air passengers (30,940) times the proportion using private car in 1979 (54.4%) times the proportion parking (36.6%) or driven away (63.4%).

8. The 1979 survey included the percentage of air-travelers who parked or were dropped off, but did not compile auto-occupancy rates. These numbers assume an auto-occupancy rate of 1.15 air-travelers.

9. Ibid., p. 6.

10. Ibid., p. 3. This is 30,940 air passengers times 11.3 percent.

11. Assumes an auto-occupancy rate of 1.15 air travelers.

12. Ibid., p.3. This is 30,940 air passengers times 5.1 percent.

13. Ibid., p. 4. This is 1,578 limousine passengers divided by a limousine occupancy rate of 3.6.

14. Ibid., p. 3. This is 30,940 air travelers times 19.6 percent.

15. Ibid., p. 4. This is 6,064 air travelers divided by a taxi occupancy rate of 0.74.

16. Ibid., p. 3. This is 30,940 air travelers times 6.3 percent.

17. Ibid., p. 3. This is 30,940 air travelers times 3.3 percent.

18. Ibid., p. 4. This assumes a bus-occupancy rate of 9.7 air-passengers.

19. Ibid., p. 7. The No-Build portion of this table is taken directly from the table on p. 7 of the 1982 memorandum. The Build portion was constructed in terms of mode-split specifically for this document. In 1982, the Build estimate was done as a simple extrapolation, using the overall 1979 relationship between number of air passengers and associated ground traffic. The same is true for the employee-related activity.

Footnotes

20. Ibid., p. 7.

21. Ibid., p. 7.

22. Ibid., p. 8. This is 10,868 employees times 81.3 percent.

23. Ibid., p. 8. In 1979, 202 of 576 passengers (or 35 percent) were assumed to be dropped off. Therefore, 35 percent of the 6.8 percent of all employees who were passengers were dropped off, or 10,868 times 0.35 times 0.068.

24. Ibid., p. 8. Assumes a vehicle-occupancy rate of 1.1 employees.

25. Ibid., p. 8. The remaining 65 percent of passengers in 1979 were assumed to be members of carpools.

26. Ibid., p. 8. These are the 1979 mode shares times 10,868 employees.

27. Ibid., p. 9. The same assumptions were made here as for the No-Build taxi share.

28. Ibid., p. 9. Assumes a motorcycle-occupancy rate of 1.2 employees.

29. Ibid., p. 9. As for the No-Build case, the "other" category was assumed to create 50 percent as many vehicle-trips as person-trips.

30. Ibid., p. 8.

31. Ibid., p. 9.

32. Ibid., p. 9.

33. The "parked" category from Table 2 above plus the "drive" and "carpool" categories from Table 3.

34. The "driven away" category from Table 2 and the "drop off" category from Table 3.

35. There are taken directly from Table 2 above, as they reflect passenger activity only.

36. These are simple combinations of the appropriate categories from Table 2 and Table 3 above.

37. These are taken directly from Table 3 above, as they reflect employee activity only.

38. Ibid., p. 15.

MEMO TO: Matthew Coogan, EOTC
Norm Faramelli, Massport

FROM: Barry Faulkner and Steven Pitschke

DATE: March 20, 1984

RE: Analysis of Airport Access Mode Change with Shuttle Bus from South Station, via New Third Harbor Crossing, including improved highway times

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1.0 Summary The air passenger access demand model, developed for Mas port by Cambridge Systematics, was used to estimate the impact of a new tra sit alternative which would be made possible by the proposed third harb crossing and Central Artery Improvements. This new transit access would co sist of a shuttle bus to the Logan terminals directly from South Static using the new tunnel which would exit on airport property.

The shuttle alternative would reduce transit access time to the airpo for a large number of air travellers, and in most cases, would reduce the nu ber of transfers.

In a previous analysis (March 5, 1984), the above-described model w used to predict the impact of these travel time improvements alone (that i without consideration of travel time improvements to other modes, which mig result from construction of the Third Harbor Crossing and improved Centr Artery). The effect of the shuttle bus alone would be to increase the numb of air passengers using transit to get to the airport by 20 percent, from 6.63 percent share of all air passenger trips to 7.99 percent.

The analysis conducted for this memorandum includes the impact of highw travel time improvements on Logan-bound traffic, as well as the shuttle b improvements. The reduction of queues on the Central Artery and the Harb

nnels provides a significant improvement in travel time for all highway ers, including limos, taxis, private automobiles, and rental cars. This provement has the effect of making non-transit travel more attractive, with expected increase in the share of airport-bound travel for these modes.

With these improvements (and the shuttle bus improvements described ove), the transit share of travel to Logan by air passengers would be 7.44 rcent. This is 7 percent lower than the impacts of the shuttle bus alone, t is still 12 percent higher than the current transit share for air passen-rs going to the airport. The share of passengers using express bus or limo rectly to the airport is virtually the same.

The impact on mode choice for air passengers in unexpectedly small, con-dering the large highway travel time savings. Part of the reason for this that most of the travel time savings occurs during the peak hours, while st air travel occurs during non-peak traffic hours.

2.0 Background The final Environmental Impact Statement (EIS) for the ird Harbor Crossing/Central Artery project is nearing completion. In con-nction with this project, Massport planners requested that Cambridge Systema-tcs use the air passenger access demand model developed for Massport to esti-te the impact of a transit improvement option which would be made possible that highway project.

The access demand model was developed in 1980-81, based on a survey of ar passengers at Logan in 1979. The model is a disaggregate, logit-based dmand model which estimates access mode shares based on attributes of each of te modal choices available (and on certain socio-economic characteristics of te air passenger, as represented by the respondents to the 1979 survey). The ructure and coefficients of this model are described in previous reports bmitted to Massport.

The new transit option consists of a shuttle bus which would leave fro South Station, proceed through the new harbor tunnel to the airport acces road, stopping at each terminal. The estimated running time from South Sta tion to the airport access road is six minutes, about four minutes longer tha the present shuttle to the same point. The shuttle bus would have headway comparable to the existing shuttle from Airport Station on the Blue Line. Th existing shuttle would continue at half of its present frequency. The shuttl bus fare is assumed to be the same as the current fare (25 cents).

The new shuttle would provide certain improvements in the "level of ser vice" perceived by transit users, most notably, fewer transfers, reduced tra vel time, and improved travel time reliability. These changes in level o service would make the transit access option more attractive to air passen gers, and a greater number of these passengers can be expected to choose th transit access mode.

At the same time, the improvements to the Central Artery, and the con struction of the Third Harbor Crossing, would substantially reduce the trave time on the Central Artery and in the tunnels. This travel time improvemen occurs primarily by reducing the traffic queues which regularly build up be hind several major bottlenecks.

<u>3.0 Estimated Level-of-Service Changes</u> The Base Case used in this anal ysis is the highway and transit system which existed in 1979, with the addi tion of the Red Line extension to Alewife Brook Parkway, scheduled to open i early 1985. The new level-of-service numbers are expressed as a <u>change</u> fro these base numbers.

<u>Transit Level-of-Service.</u> The access model recognizes a number of dif ferent components of total transit travel time (although these component

simply added together to produce one or two composite travel time vari-
es). These components include: initial wait time, transfer wait time, walk
ne, line-haul time for each mode, and the total number of transfers. In
dition, total transit fare is an important level-of-service variable.

Travel time improvements from the shuttle alternative would be realized
several ways:

- o Transfers. For many users, the shuttle bus from South Station (on the Red Line) means one or two fewer transfers. No group experiences an increase in the number of transfers. The walk time between one rapid transit platform and another (or between the platform and the bus loading area) is included in the analysis. A tranfer time of 1.5 minutes is estimated between the Red Line at South Station and the shuttle bus loading area.

- o Wait time. Each transfer has associated with it a wait time, equal to one-half of the headway (time between trains) of the line being transferred to. The 1979 peak and off-peak headways are used in both the base case and the shuttle alternatives.

- o Line-haul time. Most users will experience a reduction in the rapid transit line-haul time (by avoiding the Blue Line link to Airport Station). The time on the shuttle bus, however, is expected to increase by four minutes, compared to the shuttle bus now serving Airport station. Station-to-station times are computed from MBTA records.

- o Fare. Only passengers who would enter the rapid transit system at South Station would have any change in fares. In this case, they would avoid the 60-cent rapid transit fare altogether.

The impact of the new shuttle service out of South Station depends upon
origin of the trip to the airport (or destination of trip <u>from</u> the air-
t). Consequently, the Eastern Massachusetts area was divided into nine
arate sub-areas, or corridors, each of which will experience different de-
es of change in service quality. The nine areas are:

A. Red Line South. These are users who would approach South Station on the Red Line from the Southerly direction. This area is a corridor which extends from South Boston out to Hingham and

Brockton, including Dorchester and Quincy. These users would transfer to the shuttle at South Station instead of continuing to Airport station on the rapid transit system--this eliminates two transfers (Red Line to Green Line and Green Line to Blue Line), and the rapid transit line time between South Station and the Airport, with an additional shuttle bus time of 4 minutes..

B. South Station area. These are users who either walk directly to South Station from the financial district in Boston, or who arrive at South Station on commuter rail or suburban bus. The commuter rail/express bus market includes many of the suburbs beyond Route 128, in an arc from Framingham down to Stoughton and Plymouth. These users will receive the largest improvement in travel time. The travel time savings would be similar to those of Group A, except that Group B realizes additional savings from eliminating the initial wait for the Red Line at South Station, with a savings of the 60-cent rapid transit fare.

C. Red Line North. These users approach the downtown area on the Red Line from the northerly direction. This area includes Cambridge, Watertown, Belmont, Arlington, and parts of Somerville, Medford and other communities where bus lines feed into the Red Line. These users would save two transfers. Their rapid transit travel time would be reduced by the difference between the Park-to-Airport time and the Park-to-South-Station time.

D. Orange Line South. This corridor extends from Boston's South End to West Roxbury. These users would benefit by changing to the Red Line at Washington instead of the Blue Line at State.

E. Orange Line North. This corridor extends from Haymarket Station out to Malden. It includes zones which are served by commuter rail from North Station or by buses into Haymarket. These commuter rail/express bus zones include many of the suburbs beyond 128, from Concord north to Gloucester, and North Shore communities such as Lynn, Salem and Swampscott. For these users, transferring to the Red Line to South Station would be a better choice than transferring to the Blue Line to Airport; however, this does not represent a significant improvement over their present travel time.

F. Green Line West. This corridor extends from the Back Bay out to Newton. This group would receive benefits similar to Group D.

G. Green Line North. This is a relatively small corridor which includes East Cambridge, and certain Somerville neighborhoods which will continue to feed into Lechmere station, even after the Red Line opens to Davis and Alewife. This group is similar to Group E.

H. Blue Line. Those users whose primary access to the transit system is via the Blue Line now have the best travel times to the airport. These users will see a small increase in travel time, due to the reduced frequency of shuttle service at Airport station. This area includes East Boston, Winthrop, Revere, parts of Chelsea and certain zones in downtown Boston near Blue Line stations.

I. Downtown. Certain zones in downtown Boston are now served by one line, or combination of lines for airport trips. These zones will benefit from shifting to the Red Line to take the shuttle from South Station. An example is zone which includes the State House. Currently, users here would walk to Government Center station to board the Blue Line. With the new shuttle, they would walk to Park Street to board the Red Line.

The CTPS zones which are included in each of these areas, as well as the anges in individual travel time components, are shown on the worksheets inuded as an attachment to the March 5, 1984 memo.

Highway Level-of-Service. In a similar manner to the analysis done for ransit time, the greater Boston region was divided into corridors in or to ssess the impacts of highway travel time improvements. These improvements esults from the reduction in the length of traffic queue which occur at critcal points on the Central Artery, its approaches, or in approaches to the two arbor tunnels. For the highway improvements, the travel time impacts used ere an average of the to-airport and from-airport travel times. The corriors examined were:

- North. These are the communities which use Interstate 93 to goi to and from Logan, including Somerville (part), Medford, Winchester, Stoneham, Burlington, Reading, and points north. These travellers realize travel time improvements from a reduction in the queue at the Charles River Bridge, going to Logan, and at the tunnel, going from Logan. Average time savings are 7 minutes in the morning peak, and 12 minutes in the evening peak.

- Far West. These are the communities which use the Mass. Pike to get to and from Logan, including part of Brighton and Allston, Waltham, Newton, Lincoln, Concord, Needham, Wellesley, and points west. There is relatively little queueing on the Pike, but travellers would avoid the tunnel congestion. Travel time improvements

average 3 minutes in the morning, 11.6 minutes in the afternoon.

- Near West. These are the communities using Storrow Drive to get to and from the airport, including Cambridge and parts of Somerville, Watertown, Arlington, Belmont, Back Bay, Brookline, Jamaica Plain. Time savings, including improvements at Leverett Circle and the tunnel, average 3.5 minutes in the morning and 9.3 minutes in the afternoon.

- South. These are the communities approaching the airport from the Southeast Expressway, including Dorchester, part of Roxbury, Milton, Quincy, and points south and east. Savings occur on both the Artery and the tunnel. Average highway travel time savings are 6.6 minutes each way in the morning and 16.2 minutes each way in the afternoon rush.

- Downtown. Savings here occur chiefly on the westbound tunnel trip. Average savings are 3.1 minutes in the morning, and 8.2 minutes in the afternoon.

4.0 Results. The changes in access mode, as predicted by the model, are shown in Appendix B. The number of "airpax person-trips" under "main mode" is the critical evaluation number. These numbers are reproduced in Table 1, below, for the base case, the shuttle-only case (no highway time changes considered), and for the shuttle-plus-highway times case.

The total number of air passengers remains the same under each alternative--a basic assumption of the model is that total air travel demand is not affected by small changes in access mode levels of service; only the choice of mode is changed.

The number of air travellers who use the MBTA/airport shuttle to get to the terminal increases by 12 percent under the new shuttle alternative (including highway time impacts), from 6.63 percent modal share, to 7.44 percent. The size of this impact is, as expected, less than that of the shuttle bus alternatives alone, without highway time improvements (7.99 percent transit share). However, the modal share for transit is still greater under this scenario, than the current transit share.

Table 1
Estimates of Modal Shares
Air Passengers

Airport Access Mode	Base Case #	Base Case %	Shuttle Only #	Shuttle Only %	Shuttle + Hwy #	Shuttle + Hwy %
MBTA (shuttle bus from So. Station or Airport Station)	2,235	6.63	2,691	7.99	2,507	7.44
Express Bus/Limo (directly to airport)	3,004	8.92	2,960	8.79	2,968	8.81
Taxi	6,643	19.72	6,520	19.35	6,556	19.46
Rental Car	4,049	12.02	3,988	11.84	3,995	11.86
Auto, accompanied by family or associates	11,116	33.00	10,959	32.53	11,081	32.89
Auto, unaccompanied	6,641	19.71	6,570	19.50	6,582	19.54
TOTALS	33,689	100.0	33,689	100.0	33,689	100.0

The impacts on mode choice between the shuttle-alone and the with-highway cases are small, considering the size of the highway travel time impacts analyzed. The major reason for this result is that the highway travel time improvements analyzed (queue length reductions) occur primarily during peak highway traffic times, while only a portion of air travel occurs during these times. The peak air travel time is ususally Friday evening or Sunday afternoon. So, while the size of the impact is large in terms of minutes for affected users, the number of Logan air travellers affected is relatively small.

Several measures have been proposed (in addition to shuttle service from South Station) to mitigate the impacts of improved highway time to the airport on mode choice. These measures include limits on the number of parking spaces at the airport, or restrictions on the use of those spaces, and significant

improvements to the non-MBTA bus and limo service to and from the airport. Each of these actions was specifically analyzed in previous work by Cambridge Systematics, using the Massport access model. This analysis is fully described in a Technical Memorandum dated August 26, 1981. The analysis showed that parking constraints (accompanied by a 35 percent price increase) would increase transit use by 1.9 percent, and limo use by 2.8 percent (this refers to the increase in the number of people using each mode, not to absolute changes in the modal share). Similarly, improvements in express bus and limo service quality were found to increase express bus and limo use by 28.8 percent, with corresponding drops in the use of other modes (i.e. drive alone would decrease by 4.4 percent and transit would decrease by 2.3 percent).

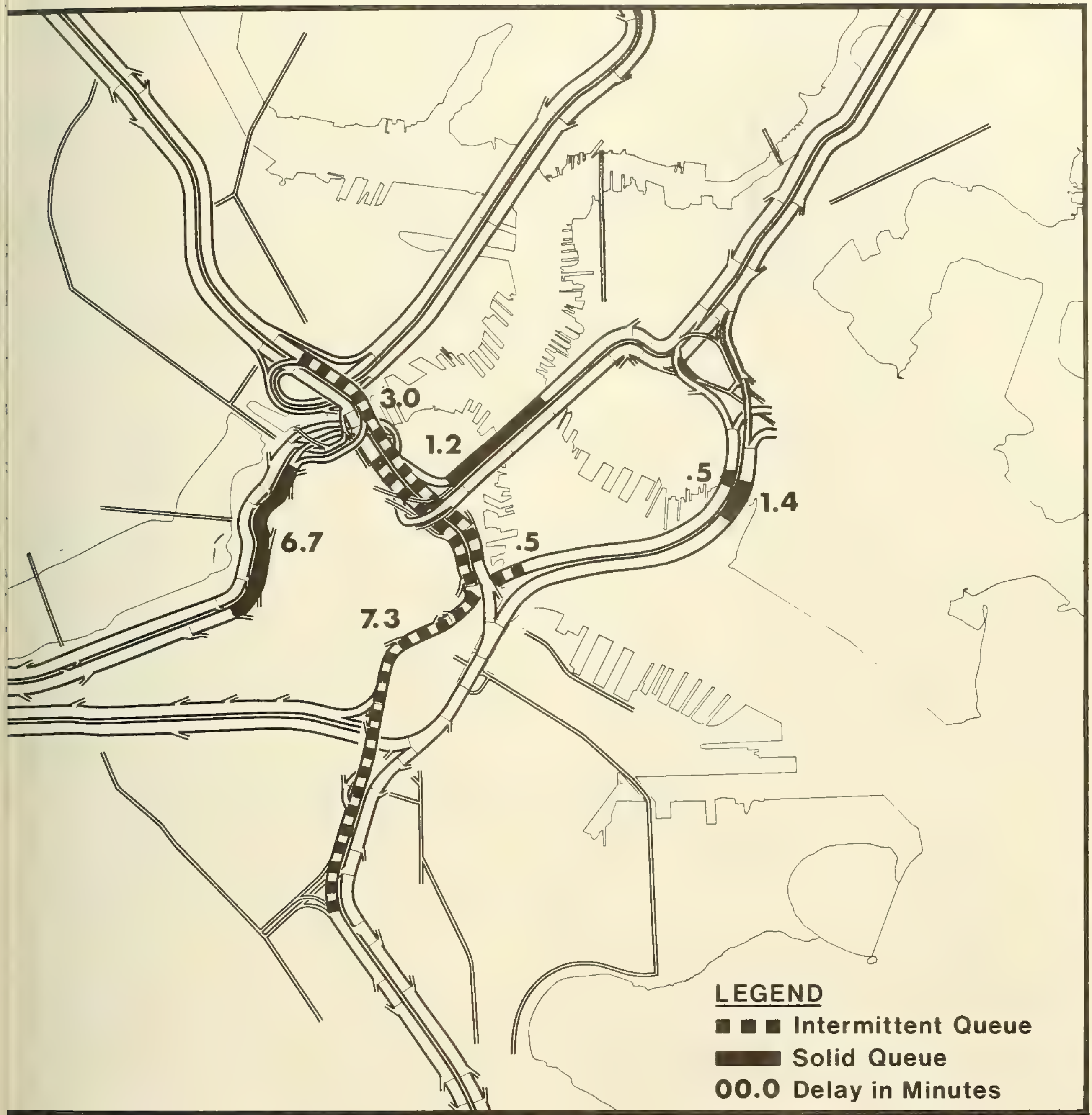

Figure 24

Alternative 3A – Mainline Queues and Delays – 1990 P.M. Peak

EIS/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

2.0 minutes. The Third Harbor Tunnel would have a small delay of 0.8 minutes southbound at the toll booths in East Boston.

Central Artery and harbor crossing-related delays during the PM peak would tend to be similarly small. As shown in Figure 24, northbound Central Artery delays would only be 3.0 minutes, and Sumner Tunnel delays would be 1.2 minutes. Third Harbor Tunnel delays would be 0.5 minutes southbound and 1.4 minutes northbound. On the Massachusetts Turnpike, there would be no PM peak period delays.

The only substantial PM peak queues and delays for Alternative 3A would be on Storrow Drive and the Central Artery southbound. The Storrow Drive eastbound delay of 6.9 minutes would remain because no attempt has been made in Alternative 3A (or any alternative) to deal with the Leverett Circle problem. The southbound Central Artery delays of 7.3 minutes would be related not to inadequate Central Artery capacity, but to inadequate capacity of the Southeast Expressway.

2.9 The Preferred Alternative - Daily V/C, Queues, and Delays (1990)

The Preferred Alternative is almost the same as Alternative 3A, except that the southern portion of the Third Harbor Tunnel begins in South Boston rather than in the Fort Point Channel area of the Split Alignment. Within the South Boston area, the Preferred Alternative has a two-part interchange connecting to Summer Street and Northern Avenue.

The similarity between the Preferred Alternative and Alternative 3A is readily seen in the daily V/C statistics illustrated in Figure 25 for the Preferred Alternative. As with Alternative 3A, most of the Central Artery would have daily volumes that are less than practical capacity (and those segments shown with volumes above practical capacity would have volumes that are only jus barely above practical capacity). Similarly, both the Sumner-Callahan tunnels and the Third Harbor Tunnel would have volumes that are less tha practical capacity. As with all of the other alternatives, I-93, Route 1 and Route 1A traffic volumes would be all less than 0.75 of daily practical capacity; Storrow Drive and the Massachusetts Turnpike would tend to range from less than 0.75 of practica capacity to between 0.75 of practical capacity and 1.00 times practical capacity. The Southeast Expressway would mostly be between 1.00 times practical capacity and 1.25 times practical capacity.

The similarity between daily volume/capacity relationships for Alternative 3A and the Preferred Alternative can also be seen in the A and PM peak queues and delays. Durin the AM peak, illustrated in Figure 26 queuing delays would again be minimal ranging downward from 3.6 minutes northbound on the Southeast Expressway. AM peak delays on I-93 and the Mystic-Tobin Bridge southboun would be 2.5 minutes. Sumner Tunnel delays would be 1.3 minutes. Third Harbor Tunnel delays southbound in South Boston would be about 2 minutes. Massachusetts Turnpike eastbound delays would be 1.6 minutes and Storrow Drive eastbound delays would be 2.5 minutes.

During the PM peak, queues and delays in the Preferred Alternative would reflect the same traffic circumstance as Alternative 3A: relief of the Central Artery and harbor crossing bottlenecks, but not of capacity constraints related to Leverett Circle and the Southeast Expressway. Thus, as shown in Figure 27, northbound Central Artery delays would be 3.3 minutes; Sumner Tunnel delays would be 1.4 minutes; and, northbound Third Harbor Tunnel delays would be 0.8 minutes. But, eastbound Storrow Drive delays remain at 6.9 minutes leading to Leverett Circle, and Southbound Central Artery delays would be 7.6 minutes leading to the Southeast Expressway. Similarly,

APPENDIX A: Zones affected by Highway Time Improvements

Corridor	CTPS Zones Included	Travel Time Changes AM Peak	PM Peak
North	230-237, 269-279, 300-313, 409-410, 487-489, 491, 552-562	-7.0	-12.0
Far West	329-339, 344-360, 490, 492-530 426-429, 432-436, 440-446, 563-582, 185-192	-3.0	-11.6
Near West	437-439, 314-328, 340-343, 200-229, 238-244, 161-183, 245-256, 26-43, 95-98	-3.5	-9.3
South	447-479, 531-541, 583-592, 131-160, 99-130	-6.6	-16.2
Downtown	1-25, 44-60, 81-94	-3.1	-16.3
North Shore		no change	

APPENDIX B: Results of Model Runs

ST SUMMARIES   Alt2: Shuttle bus with highway time improvements

PAX PERSON-TRIPS

N MODE

EG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
LOC	699	812	1761	305	2946	5286	11808
NON	578	772	2608	2708	1001	0	7667
LOC	607	891	756	47	5376	1296	8973
NON	622	493	1431	935	1758	0	5240
AL	2507	2968	6556	3995	11081	6582	33689

ITAL CAR

SEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
LOC	12	40	253	305
NON	104	351	2253	2708
LOC	2	6	39	47
NON	56	146	734	935
AL	174	542	3279	3995

PARK

SEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LOC	1963	296	687	2946
NON	588	115	298	1001
LOC	2796	651	1929	5376
NON	769	318	672	1758
AL	6116	1380	3586	11082

PARK

SEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
SLOC	4981	305	5286
SNON	0	0	0
ALOC	1184	112	1296
ANON	0	0	0
TAL	6165	417	6582

Alt 2

VEHICLE TRIPS

MAIN MODE

MKTSEG	MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	0	1386	229	4589	4036
BUSNON	0	0	1964	2149	1683	0
PLALOC	0	0	483	35	6560	756
PLANON	0	0	905	664	2559	0
TOTAL	0	0	4738	3077	15391	4792

(MAIN_MODE)

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1014)

RENTAL CAR

MKTSEG	OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	30	190	229
BUSNON	83	279	1788	2149
PLALOC	2	4	29	35
PLANON	39	101	524	664
TOTAL	132	413	2531	3077

(RENT_TYPE)

A/A PARK

MKTSEG	CURB	METER	GARAGE	TOTAL
BUSLOC	3067	465	1057	4589
BUSNON	995	191	497	1683
PLALOC	3336	814	2411	6561
PLANON	1139	463	958	2559
TOTAL	8537	1932	4923	15392

(PARK_TYPE)

A/U PARK

MKTSEG	ON-A/P	PARK/FLY	TOTAL
BUSLOC	3847	189	4036
BUSNON	0	0	0
PLALOC	705	52	756
PLANON	0	0	0
TOTAL	4552	240	4792

(PARK_TYPE)

C MPANION PERSON-TRIPS

M IN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	0	18	130	0	6795	0	6943
BUSNON	30	48	70	203	2084	0	2435
PLALOC	29	167	59	21	10462	0	10738
PLANON	287	37	129	127	4283	0	4863
TOTAL	346	270	388	351	23624	0	24980

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	0	0	0	0
BUSNON	8	26	169	203
PLALOC	1	2	17	21
PLANON	8	20	100	127
TOTAL	16	49	286	351

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	4215	545	2035	6795
BUSNON	1108	303	673	2084
PLALOC	4346	1588	4529	10462
PLANON	1606	832	1845	4283
TOTAL	11274	3269	9081	23624

AIRPAX CONSUMER SURPLUS Alt 2

MKTSEG	DOLLARS	MINUTES
BUSLOC	-670011	-469828
BUSNON	-57536	-173729
PLALOC	507731	158670
PLANON	-122797	-51698
TOTAL	-342613	-536584

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	0	23479	13506	142942	142581
BUSNON	0	0	15455	104182	71489	0
PLALOC	0	0	11883	1537	239505	40329
PLANON	0	0	15030	41539	106915	0
TOTAL	0	0	65846	160763	560851	182910

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26231)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	922	7469	36036	6646	7655	53496
BUSNON	576	5449	24118	60970	3958	0
PLALOC	1078	8652	18183	737	12701	13883
PLANON	825	3372	22808	20024	5669	0
TOTAL	3401	24940	101144	88377	29982	67379

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	42155	65959	70706	34555	151711	316175
BUSNON	25092	49352	66455	256783	60670	0
PLALOC	50983	82724	39436	4459	323399	110169
PLANON	33612	29500	51342	110390	113489	0
TOTAL	156842	227536	227938	406185	649269	426345

V.NUES (DOLLARS) Alt 2

T:EG	MBTA	MPA_BUS	XBUS	TAXI
S.OC	748	175	7636	37366
S:ON	454	152	5785	24441
A.OC	969	159	10275	18894
A:ON	978	227	3626	23837
T:L	3149	713	27322	104536

R:ING REVENUES (DOLLARS)

.:SEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
S.OC	232	529	27232	1254
S:ON	96	248	0	0
.A.OC	407	1206	9170	665
.A:ON	231	479	0	0
:AL	966	2461	36402	1919

:/A PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
.I SEGS	274	699	6864	7837

MEMO TO: Matthew Coogan, EOTC
and
Norm Faramelli, Massport

FROM: Barry Faulkner and Steven Pitschke

DATE: March 5, 1984

RE: Analysis of Airport Access Mode Change with Shuttle Bus fr
South Station, via New Third Harbor Crossing

1.0 Summary The air passenger access demand model, developed for Mas port by Cambridge Systematics, was used to estimate the impact of a new transit alternative which would be made possible by the proposed third har crossing and Central Artery Improvements. This new transit access would consist of a shuttle bus to the Logan terminals directly from South Statio using the new tunnel which would exit on airport property.

The shuttle alternative would reduce transit access time to the airpo for a large number of air travellers, and in most cases, would reduce the number of transfers.

Using the above-described model, the predicted impact of these travel time improvements alone (that is, without consideration of travel time improvements to other modes, which might result from construction of the Tl Harbor Crossing and improved Central Artery) would be to increase the numb of air passengers using transit to get to the airport. The transit share air passenger trips would increase by 20 percent, from 6.63 percent of all passenger trips to 7.99 percent.

The model, as calibrated with 1979 air passenger survey data, does not treat transfers and transfer time any differently than in-vehicle time. W the model altered to make it more sensitive to the number of transfers, the

predicted impact of the new shuttle service would be to increase the transit access share by 43 percent--from 6.63 percent to 9.45 percent.

2.0 Background The final Environmental Impact Statement (EIS) for the Third Harbor Crossing/Central Artery project is nearing completion. In connection with this project, Massport planners requested that Cambridge Systematics use the air passenger access demand model developed for Massport to estimate the impact of a transit improvement option which would be made possible by that highway project.

The access demand model was developed in 1980-81, based on a survey of air passengers at Logan in 1979. The model is a disaggregate, logit-based demand model which estimates access mode shares based on attributes of each of the modal choices available (and on certain socio-economic characteristics of the air passenger, as represented by the respondents to the 1979 survey). The structure and coefficients of this model are described in previous reports submitted to Massport.

The new transit option consists of a shuttle bus which would leave from South Station, proceed through the new harbor tunnel to the airport access road, stopping at each terminal. The estimated running time from South Station to the airport access road is six minutes, about four minutes longer than the present shuttle to the same point. The shuttle bus would have headways comparable to the existing shuttle from Airport Station on the Blue Line. The existing shuttle would continue at half of its present frequency. The shuttle bus fare is assumed to be the same as the current fare (25 cents).

The new shuttle would provide certain improvements in the "level of service" perceived by transit users, most notably, fewer transfers, reduced travel time, and improved travel time reliability. These changes in level of

service would make the transit access option more attractive to air passengers, and a greater number of these passengers can be expected to ch the transit access mode.

3.0 Estimated Level-of-Service Changes The Base Case used in this analysis is the transit system which existed in 1979, with the addition of Red Line extension to Alewife Brook Parkway, scheduled to open in early 19 The new level-of-service numbers are expressed as a change from these base numbers.

The access model recognizes a number of different components of total transit travel time (although these components are simply added together t produce one or two composite travel time variables). These components in- clude: initial wait time, transfer wait time, walk time, line-haul time fo each mode, and the total number of transfers. In addition, total transit is an important level-of-service variable.

Travel time improvements from the shuttle alternative would be realiz in several ways:

- Transfers. For many users, the shuttle bus from South Station (on the Red Line) means one or two fewer transfers. No group experiences an increase in the number of transfers. The walk time between one rapid transit platform and another (or between the platform and the bus loading area) is included in the analysis. A tranfer time of 1.5 minutes is estimated between the Red Line at South Station and the shuttle bus loading area.

- Wait time. Each transfer has associated with it a wait time, equal to one-half of the headway (time between trains) of the line being transferred to. The 1979 peak and off-peak headways are used in both the base case and the shuttle alternatives.

- Line-haul time. Most users will experience a reduction in the rapid transit line-haul time (by avoiding the Blue Line link to Airport Station). The time on the shuttle bus, however, is expected to increase by four minutes, compared to the shuttle bus now serving Airport station. Station-to-station times are computed from MBTA records.

- o Fare. Only passengers who would enter the rapid transit system at South Station would have any change in fares. In this case, they would avoid the 60-cent rapid transit fare altogether.

The impact of the new shuttle service out of South Station depends upon the origin of the trip to the airport (or destination of trip <u>from</u> the airport). Consequently, the Eastern Massachusetts area was divided into nine separate sub-areas, or corridors, each of which will experience different degrees of change in service quality. The nine areas are:

A. Red Line South. These are users who would approach South Station on the Red Line from the Southerly direction. This area is a corridor which extends from South Boston out to Hingham and Brockton, including Dorchester and Quincy. These users would transfer to the shuttle at South Station instead of continuing to Airport station on the rapid transit system--this eliminates two transfers (Red Line to Green Line and Green Line to Blue Line), and the rapid transit line time between South Station and the Airport, with an additional shuttle bus time of 4 minutes..

B. South Station area. These are users who either walk directly to South Station from the financial district in Boston, or who arrive at South Station on commuter rail or suburban bus. The commuter rail/express bus market includes many of the suburbs beyond Route 128, in an arc from Framingham down to Stoughton and Plymouth. These users will receive the largest improvement in travel time. The travel time savings would be similar to those of Group A, except that Group B realizes additional savings from eliminating the initial wait for the Red Line at South Station, with a savings of the 60-cent rapid transit fare.

C. Red Line North. These users approach the downtown area on the Red Line from the northerly direction. This area includes Cambridge, Watertown, Belmont, Arlington, and parts of Somerville, Medford and other communities where bus lines feed into the Red Line. These users would save two transfers. Their rapid transit travel time would be reduced by the difference between the Park-to-Airport time and the Park-to-South-Station time.

D. Orange Line South. This corridor extends from Boston's South End to West Roxbury. These users would benefit by changing to the Red Line at Washington instead of the Blue Line at State.

E. Orange Line North. This corridor extends from Haymarket Station out to Malden. It includes zones which are served by commuter rail from North Station or by buses into Haymarket. These commuter rail/express bus zones include many of the suburbs beyond

128, from Concord north to Gloucester, and North Shore communities such as Lynn, Salem and Swampscott. For these users, transferring to the Red Line to South Station would be a better choice than transferring to the Blue Line to Airport; however, this does not represent a significant improvement over their present travel time.

F. Green Line West. This corridor extends from the Back Bay out to Newton. This group would receive benefits similar to Group D.

G. Green Line North. This is a relatively small corridor which includes East Cambridge, and certain Somerville neighborhoods which will continue to feed into Lechmere station, even after the Red Line opens to Davis and Alewife. This group is similar to Group E.

H. Blue Line. Those users whose primary access to the transit system is via the Blue Line now have the best travel times to the airport. These users will see a small increase in travel time, due to the reduced frequency of shuttle service at Airport station. This area includes East Boston, Winthrop, Revere, parts of Chelsea and certain zones in downtown Boston near Blue Line stations.

I. Downtown. Certain zones in downtown Boston are now served by one line, or combination of lines for airport trips. These zones will benefit from shifting to the Red Line to take the shuttle from South Station. An example is zone which includes the State House. Currently, users here would walk to Government Center station to board the Blue Line. With the new shuttle, they would walk to Park Street to board the Red Line.

The CTPS zones which are included in each of these areas, as well as changes in individual travel time components, are shown on the worksheets included as an attachment to this memo.

4.0 Results. The changes in access mode, as predicted by the model, shown in Appendix B. The number of "airpax person-trips" under "main mod the critical evaluation number. These numbers are reproduced in Table 1, below.

The total number of air passengers remains the same under both alter tives--a basic assumption of the model is that total air travel demand is affected by small changes in access mode levels of service; only the choi mode is changed.

The number of air travellers who use the MBTA/airport shuttle to get to the terminal increases by 20 percent under the new shuttle alternative, from 6.63 percent modal share, to 7.99 percent. The size of this impact is much greater than that of several parking price alternatives previously examined (which resulted in up to 7.06 modal share for transit). It also has a greater impact than connecting the Blue Line downtown to either Charles or Park Street stations. The proposal to extend, in addition to the downtown extension, the Blue Line directly into the airport, with moving sidewalk to connect with the

Table 1
Estimates of Modal Shares
Air Passengers

Airport Access Mode	Base Case #	Base Case %	New Shuttle #	New Shuttle %
MBTA (shuttle bus from So. Sta. or Airport station)	2,235	6.63	2,691	7.99
Express Bus/Limo (directly to airport)	3,004	8.92	2,960	8.79
Taxi	6,643	19.72	6,520	19.35
Rental Car	4,049	12.02	3,988	11.84
Auto, accompanied by family or associates	11,116	33.00	10,959	32.53
Auto, unaccompanied	6,641	19.71	6,570	19.50
TOTALS	33,689	100.0	33,689	100.0

terminals, would produce a greater transit share (8.60 percent of the total). The technical or cost feasibility of this option has not been fully examined. In addition, the original analysis of the impacts of the Blue Line spur to the airport did not consider any impacts to Blue Line riders beyond the airport. Splitting of this line into two branches (Airport and Wonderland) will

probably require a reduction in service frequency to Wonderland because of minimum headway restrictions in the Blue Line tunnel. Additional delays whe the two branches merge were also omitted from the original analysis. A full operational analysis of this extension would be required to properly assess these impacts. A preliminary analysis indicates that a 3-minute headway limitation in the tunnel (6 minute on each branch) would result in a 1-minut additional wait time for the passengers who use the Blue Line beyond Airport station during peak hours. (An estimated 60 percent of the 10,500 daily rou trips on this line occur during peak hours.) This aggregate travel time impact would partially offset the improvements for current airport users.

In previous studies, it was recognized that the access demand model is not very sensitive to the number of transfers which must be made by transit users going to the airport (This is a result of a peculiarity of the data collected in the 1979 survey. The survey data indicated, empirically, that transfers had little effect on mode choice; however, other experience has shown transfers to be very onerous, as perceived by the transit user.). We repeated an analysis done for previous studies, in which the time penalty fo each transfer was increased from one minute to six minutes, to determine how sensitive the model results are to this change.

When the model is artifically constrained this way, the increase in transit share resulting from the new shuttle bus is nearly 43 percent. That is, the transit modal share of air passenger trips to Logan would increase from 6.63 percent of the total to 9.45 percent of the total. The difference (between the normal model estimate and the transfer-sensitive estimate) reflects the fact that a major component of the level-of-service improvement of the new shuttle is the reduction in the number of transfers made. A

similar analysis done for the Blue Line spur to the airport resulted in an estimated 10.25 percent transit share for that alternative.

It should be recognized, however, that the artificially-constrained estimate is more consistent with other experience, but will not accurately reflect the modal choices made by air travellers in the 1979 survey. Also, the estimates reported here do not consider any impacts on highway travel time resulting from the construction of the Third Harbor Crossing or Central Artery improvements. These are to be investigated separately.

APPENDIX A: Worksheets

GROUP: A (RED LINE SOUTH)

ZONES AFFECTED: 81-94 (So Bos.); 131-147, 151-158, 159, 183 (Dorch); 447-462 (Milton, Quincy); 466-479 (Brain., Wey); 534-535 (Hing, Coh); 585 (Brock); 531 (Holb); 463-65 (Rand.) 584 (Avon); 533 (Hull)

VARIABLE	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (Δ mins).	—	—	—
TTWT - transfer wait time "	-3.4	-3.4	-5.0
TWLKT - walk time "	-1.5	-1.5	-1.5
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-11.3	-11.3	-10.9
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	—	—	—
TNT - total # transfers Δ	-2	-2	-2
TOTRNFAR - total fare Δ¢	—	—	—
All LOS variables one way			

NOTES: RT vs Park ⇒ -1.3 -1.3 -2.0 (-1.6) -1.3 -1.2 -2.3 -1.9 = -11.3 (-10.9)
walk transf → Park -1, GCtr -1, So Sta +.5 = -1.5

Group: B (So Station walk, So Sta CRR, X Bus)

ZONES AFFECTED: 4-8, 2, Downtown 358-360, 3?14 Newton
441-446 (Dedh, West, Canton) 426-436 (Need/Wel)
499-530 536+541, 583-583, 586-592 (Bus) 329-339
Sowest suburbs (CRR) So Shore (Bus) 532 (Rockl) Waltham

VARIABLE	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (MINS).	-1.4	-1.4	-2.
TTWT - transfer wait time "	-3.4	-3.4	-5.
TWLKT - walk time "	-3.0	-3.0	-3.
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-11.3	-11.3	-10.
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	—	—	—
TNT - total # transfers Δ	-3	-3	-3
TOTRNFAR - total fare Δ¢	-60	-60	-60
All LOS variables one way			

NOTES: Same as A except TIWT (RL), TWLKT (transfr walk)

Group: C Red Line North

ZONES AFFECTED: 26-28, 202-204, 207-229, 233-239, 241,
Charles Camb Som
271-273, 314-328, 340-343, 345, 346, 357 185 192
Medford Bel-Ar't Watertown Newton Allston

VARIABLE	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (Δ mins)	—	—	—
TTWT - transfer wait time "	-3.4	-3.4	-5.0
TWLKT - walk time "	-2.0	-2.0	-2.0
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-6.1	-6.1	-5.7
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	—	—	—
TNT - total # transfers Δ	-2	-2	-2
TOTRNFAR - total fare Δ¢	—	—	—
All LOS variables one way			

NOTES: RT LH - 2.0 GL -1.3 - 1.2 - 2.3 - 1.9 + 1.3 + 1.3 = -6.1

Wait = GL + BL

GROUP: D ORANGE LINE So

ZONES AFFECTED: 33-39, 44-60, 99-107, 109 -
S. End / Rox
148-150, 160-173, 175-182, 184, 440
Blue Hill Av JP W Rox Dedham

VARIABLE	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (Δ mins)	—	—	—
TTWT - transfer wait time "	-.6	-.6	-.
TWLKT - walk time "	-1.0	-1.0	-1.
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-5.1	-5.1	-5.
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	-	-	-
TNT - total # transfers Δ	—	—	—
TOTRNFAR - total fare Δ¢	—	—	—
All LOS variables one way			

NOTES: RT — -1.1 -1.2 -2.3 -1.9 +1.3 = -5.1

1

Group: E   Orange Line No   (No Sta CRR, Haym Xbus)

ZONES AFFECTED: 23-25, 73-80, 230-231, 243, 269-270, 274-295
No Sta   Charlestown   Som   Med/Mal/Everett
-425, 296-318, 437-439, 480-498, 552-559
Lynn, N. Shore etc   Melr, Woburn   Lex   No Sh   Concord etc

VARIABLE	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (Δ mins)	—	—	—
TTWT - transfer wait time "	-.6	-.6	-.6
TWLKT - walk time "	-1.0	-1.0	-1.0
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-3.0	-3.0	-3.0
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	—	—	—
TNT - total # transfers Δ	—	—	—
TOTRNFAR - total fare Δ¢	—	—	—
All LOS variables one way			

NOTES: -1.2 -2.3 -1.9 +1.1 +1.3 = -3.0 RRLT

Group: F: Green Line West

ZONES AFFECTED: 29-32, 40-43, 95-98, 108, 174, 245-
Back Bay JP Brk
186-191, 347-356,
All-Br Newton

~~VARIABLE~~	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (Δ MINS).	—	—	—
TTWT - transfer wait time "	-.6	-.6	-.
TWLKT - walk time "	—	—	—
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-6.1	-6.1	-5.
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	—	—	—
TNT - total # transfers Δ	—	—	—
TOTRNFAR - total fare Δ¢	—	—	—
All LOS variables one way			

NOTES: ETL -2.0 ~~-1.3~~ -1.2 -2.3 -1.9 + 1.3 + 1.

1

Group: G Green Line No.

Zones affected: 232, 240, 242, 244, 200, 201, 205-206
Somerville Cambridge

VARIABLE	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (Δ mins).	—	—	—
TTWT - transfer wait time "	-.6	-.6	-.6
TWLKT - walk time "	—	—	—
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-2.1	-2.1	-1.7
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	—	—	—
TNT - total # transfers Δ	—	—	—
TOTRNFAR - total fare Δ¢	—	—	—
All LOS variables one way			

Notes: $-1.3 - 1.2 - \cancel{2.3} - 1.9 + 2.0 + 1.3 + 1.3 = -2.1$

G up: H Blue Line

CONES AFFECTED: 61-72, 257-268, 194-199
Eastie, Winth, Revere, Chelsea

VARIABLE	AM PEAK	PM PEAK	OF PEA
TIWT - Initial wait time (Δ mins).	—	—	—
TTWT - transfer wait time "	+4.0	+3.0	+5
TWLKT - walk time "	-	--	
TCRLT - CRR line time "	-	-	-
TRRLT - rapid transit time "	-	—	
TLBLT - local bus line time "			
TXBLT - express bus line time "	—		-
TNT - total # transfers Δ	-	—	-
TOTRNFAR - total fare Δ ¢	--	—	—
All LOS variables one way			

NOTES:

1

G UP: I Downtown

ZONES AFFECTED: 1, 3, 9, 10, 11, 13, 20-21

VARIABLE	AM PEAK	PM PEAK	OFF PEAK
TIWT - Initial wait time (Δ MINS).	-.6	-.6	-.6
TTWT - transfer wait time "	—	—	—
TWLKT - walk time "	—	—	—
TCRLT - CRR line time "	—	—	—
TRRLT - rapid transit time "	-4.1	-4.1	-4.1
TLBLT - local bus line time "	+4	+4	+4
TXBLT - express bus line time "	—	—	—
TNT - total # transfers Δ	—	—	—
TOTRNFAR - total fare Δ¢	—	—	—
All LOS variables one way			

NOTES: RC to SS instead of Bl to Air

LH -6.7 + 2.6 = -4.1

wt -.6

APPENDIX B: Results of Model Runs

T SUM ARIES BASE CASE (1979 System plus Red Line to Alewife)

A ERSON-TRIPS

MODE

EG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
.C	615	819	1792	308	2941	5335	11808
N	500	786	2643	2746	993	0	7667
.C	561	896	763	47	5399	1306	8973
N	559	503	1446	949	1783	0	5240
AL	2235	3004	6643	4049	11116	6641	33689

TL CAR

SG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
LC	12	40	255	308
NN	106	356	2284	2746
LC	2	6	40	47
NN	56	147	745	949
A.	177	549	3324	4049

PARK

EG	PARK_TYPE CURB	METER	GARAGE	TOTAL
DC	1960	296	685	2941
DN	584	115	295	993
DC	2810	655	1935	5399
DN	780	323	680	1783
L	6133	1388	3595	11117

PARK

EG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
.OC	5028	307	5335
ION	0	0	0
.OC	1193	113	1306
ION	0	0	0
AL	6221	420	6641

VEHICLE TRIPS BASE CASE

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	0	0	1412	231	4576	4075	10
BUSNON	0	0	1995	2183	1671	0	5
PLALOC	0	0	489	35	6594	763	7
PLANON	0	0	917	676	2606	0	4
TOTAL	0	0	4813	3126	15446	4838	28

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1040)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	30	192	231
BUSNON	84	283	1816	2183
PLALOC	2	4	29	35
PLANON	39	103	534	676
TOTAL	134	420	2572	3126

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	3061	464	1052	4576
BUSNON	988	191	492	1671
PLALOC	3355	818	2421	6594
PLANON	1160	472	974	2606
TOTAL	8564	1945	4938	15447

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	3885	190	4075
BUSNON	0	0	0
PLALOC	711	52	763
PLANON	0	0	0
TOTAL	4595	243	4838

CMPANIC PERSON-TRIPS

BASE CASE

MAIN M E

MTSE	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
B SLOC	0	18	132	0	6782	0	6932
B SNON	26	49	71	206	2067	0	2419
P ALOC	26	168	60	21	10506	0	10781
P ANON	258	38	130	129	4344	0	4899
TTAL	311	273	393	356	23699	0	25032

RNTAL CAR

MTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BSLOC	0	0	0	0
BSNON	8	27	171	206
PALOC	1	2	18	21
PANON	8	20	101	129
TOTAL	17	49	290	356

/A PARK

KTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
JSLOC	4210	545	2027	6782
JSNON	1099	302	666	2067
LALOC	4367	1596	4543	10506
LANON	1629	846	1869	4344
OTAL	11305	3289	9105	23699

AIRPAX CONSUMER SURPLUS BASE CASE

MKTSEG	DOLLARS	MINUTES
BUSLOC	-711246	-497782
BUSNON	-67938	-198163
PLALOC	459953	140397
PLANON	-179314	-63923
TOTAL	-498546	-619471

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	0	23759	13544	142638	143260
BUSNON	0	0	15692	104643	71177	0
PLALOC	0	0	11965	1542	240019	40452
PLANON	0	0	15204	41727	107550	0
TOTAL	0	0	66619	161456	561383	183712

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26558)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	788	7509	36464	6698	7639	53936
BUSNON	480	5521	24485	61654	3941	0
PLALOC	1000	8684	18307	743	12734	13992
PLANON	736	3421	23069	20273	5712	0
TOTAL	3004	25135	102326	89368	30025	67929

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	40528	67896	76043	35174	157819	328162
BUSNON	23747	51839	74952	264928	62819	0
PLALOC	50834	84156	41246	4561	333255	112692
PLANON	33450	30826	54917	112328	117032	0
TOTAL	153559	234716	247158	416991	670926	440854

?VENUES DOLLARS) BASE CASE

MTSE(	MBTA	MPA_BUS	XBUS	TAXI
B'SI	634	154	7677	37810
B'S' .N	374	131	5862	24813
F.ALOC	900	147	10313	19023
F.ANON	871	204	3678	24110
TJTAL	2779	636	27531	105756

ARKING REVENUES (DOLLARS)

KTSEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
USLOC	232	526	27504	1266
USNON	95	246	0	0
LALOC	409	1210	9260	671
LANON	236	487	0	0
OTAL	972	2469	36764	1937

EAK PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
LL SEGS	276	701	6930	7907

XCAST S(IARIES ALT. 1 (Shuttle bus from So. Station via 3rd Harbor Tunnel)

AIRPA -ERSON-TRIPS

MAI MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	771	810	1749	304	2899	5275
BUSNON	625	770	2594	2707	971	0
PLALOC	637	891	754	47	5348	1296
PLANON	657	489	1423	931	1740	0
TOTAL	2691	2960	6520	3988	10959	6570

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	12	40	252	304
BUSNON	104	351	2252	2707
PLALOC	2	6	39	47
PLANON	55	145	730	931
TOTAL	174	541	3273	3988

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	1932	291	676	2899
BUSNON	571	112	288	971
PLALOC	2783	648	1918	5349
PLANON	761	315	664	1740
TOTAL	6047	1367	3546	10959

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	4971	304	5275
BUSNON	0	0	0
PLALOC	1183	112	1296
PLANON	0	0	0
TOTAL	6154	416	6571

EHICLE TRIPS ALT 1

AN DE

MAIN_MODE	MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
JSLOC	0	0	1377	228	4507	4027	10140
JSNON	0	0	1953	2148	1631	0	5732
LALOC	0	0	482	35	6522	756	7795
LANON	0	0	898	660	2529	0	4086
TOTAL	0	0	4709	3071	15190	4783	27753

DAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1011)

ETAL CAR

KSEG RENT_TYPE	OFF-A/P	ON-A/P	BIG3	TOTAL
ULOC	9	30	190	228
UNON	82	278	1787	2148
LLOC	2	4	29	35
LNON	38	101	521	660
TAL	132	413	2527	3071

A PARK

TSEG PARK_TYPE	CURB	METER	GARAGE	TOTAL
SLOC	3014	456	1037	4507
SNON	965	185	481	1631
ALOC	3318	810	2396	6523
ANON	1126	458	945	2529
TAL	8423	1909	4859	15191

U PARK

TSEG PARK_TYPE	ON-A/P	PARK/FLY	TOTAL
SLOC	3839	188	4027
SNON	0	0	0
ALOC	704	52	756
ANON	0	0	0
TAL	4543	240	4783

REVEN..S DOLLARS) ALT 1

MKTSEC	MBTA	MPA_BUS	XBUS	TAXI
BUSL	816	193	7626	37299
BUS' N	492	164	5781	24382
PL/ OC	1006	167	10272	18885
PLANON	1029	240	3601	23739
TOTAL	3343	764	27280	104305

PARKING REVENUES (DOLLARS)

MKTSEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
BUSLOC	228	519	27189	1252
BUSNON	93	240	0	0
PLALOC	405	1198	9164	665
PLANON	229	472	0	0
TOTAL	954	2429	36352	1916

PEAK PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
ALL SEGS	271	690	6851	7812

CTPS

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MEMORANDUM

TO: Third Harbor Crossing Files November 15, 1983

FROM: Marc Desmarais MD
Mark Scannell MS

RE: Mode Choice and Mode Choice Impacts of the Central Artery Depression/Third Harbor Crossing on Travel To and Through Downtown Boston for the AM Peak Period

Introduction

As part of the Central Artery/Third Harbor Crossing Environmental Impact Statement (EIS) analysis, EOTC requested CTPS to estimate what the highway improvement impacts of the Central Artery Depression and the Third Harbor Crossing would be on transit ridership.

Previous analysis[1] responded to this request and concerned itself with estimating expected transit ridership change because of transit trip diversion to highway in certain corridors as a result of shorter queues and faster travel times due to the proposed Third Harbor Crossing and Central Artery Depression highway improvements. Because of the data developed for EOTC's request and since no recent studies on mode choice or mode choice impact of highway improvements were known to have been made, it was logical to go one step further in the analysis.

This memo describes trip mode choice by corridor for the 1977 AM peak period (7:00 AM to 10:00 AM) Base Case conditions. The memo also includes analysis which addresses more specifically the issue of Third Harbor Crossing/Central Artery Depression impacts on mode choice for trips destined "to the CBD" and those trips traveling "through" the CBD for destinations beyond the CBD during the AM peak period. The earlier analysis provided the total number of transit trips diverted and that total was used as part of the basis for this study. Pedestrian and local bus trips to the CBD were not included in this analysis.

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[1]See Yong Chang and Tom Lisco, "Impact of the Central Artery/Third Harbor Crossing Improvement on Public Transit Ridership," September 23, 1983.

Procedure

To estimate Base Case mode choices and the impact of the preferred Alternative 5A Modified highway improvements on mode choice, four tasks were necessary. First, it was necessary to define corridors or areas of service for highway and transit. The corridors closely followed the CTPS definition of the corridors in the region (see Map 1).

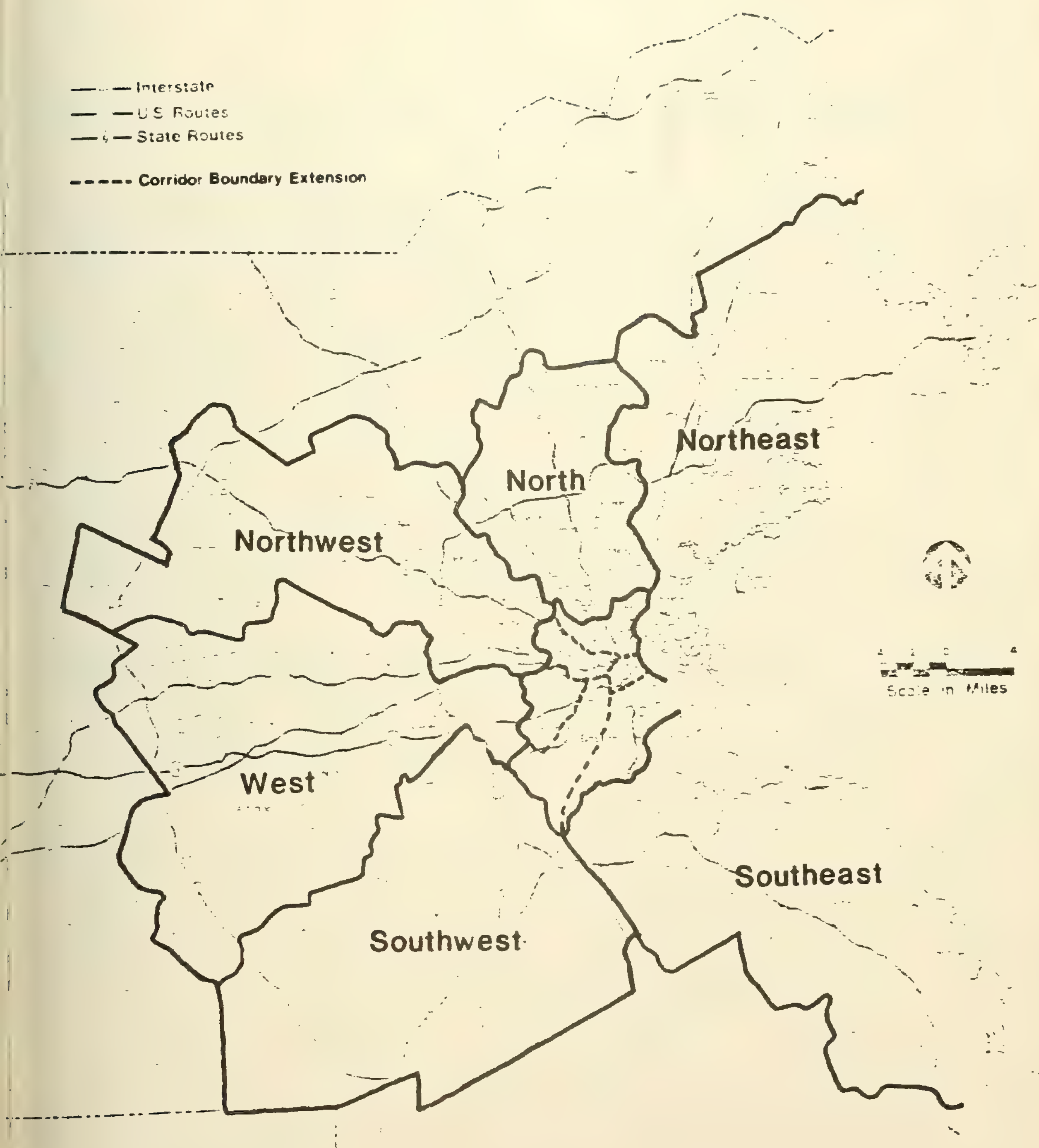
Since the CBD was defined as the downtown area, or zones 1 through 54, the remaining areas of what is called the core were parcelled out to appropriate corridors. Chelsea, for example, which is situated in the core, is apportioned to the northeast corridor. Similarly, Everett and Somerville are apportioned to the north corridor since the logical extension of the north corridor boundaries would incorporate these towns. The same procedure was done for the other towns outside of the Zone 1 through 54 downtown area.

The second task involved was to assess highway and transit service in each corridor. This was done by relating specific approaches to the downtown by highway, commuter rail, rapid transit, and express bus service to well-defined corridors.

In the third task, the numbers of trips destined "to the CBD" and trips which traveled "through the CBD" by mode were determined. For highway trips, a Select Link Analysis was done for the CTPS AM peak period (7:00 AM to 10:00 AM) 1977 Base Case Central Artery network to establish the number of trips using specific approach links "to the CBD" or traveling those links "through the CBD."

It should be noted that, even though a trip may originate from one corridor, it may in some cases use an adjacent corridor to access the CBD. For example, a trip originating from Arlington in the northwest corridor may take either I-93 or Fresh Pond Parkway-Storrow Drive to get into downtown. If I-93 is taken, then that trip originating from the northwest corridor is using a link to the CBD in the adjacent north corridor. This was accounted for when doing the analysis for highways, and such trips are allocated to the originating corridor.

Trips made on public transportation were also separated by those trips destined "to the CBD" and trips "through the CBD." To obtain passenger loadings during the period 7:00 AM to 10:00 AM for trips "to" and "through" the CBD, several data sources were used. The 1978 MBTA Systemwide Survey was processed to get AM peak period boardings for rapid transit. For commuter rail, the 1976 Commuter Rail Survey produced equivalent data for the analysis. Various project studies, peak load point counts, and available in-house data were used to develop express bus volume



CTPS TRANSPORTATION CORRIDORS

MAP 1

for the AM peak period "to" and "through" trips. It was assumed that for commuter rail and express bus service, all trip destinations would be "to the CBD."

Fourth, after the corridors were identified and "to" and "through" trips separated from total trips for both highway and transit, several additional tasks were done. The following is a summary of those tasks for the final purpose of calculating mode splits before and after improvements.

1. Convert highway vehicle trips to highway person trips.

2. Determine mode split for "to trips" and "through trips" before improvements.

3. Get "total transit trips diverted" from September 23 memorandum.

4. Calculate relationship of "to CBD" and "through CBD" trips for transit as a percentage of the total for transit trips and assume that this relationship remains the same after improvements.

5. Apply this proportion to the September 23 supplied "total trips diverted" to get "to" diverted trips and "through" diverted trips after improvements.

6. Subtract "to" diverted trips from original total transit trips to get total transit trips "to CBD" after improvements.

7. Add these "to" diverted trips to highway for "to CBD" to get total highway person trips after improvements.

8. Do 6 and 7 for "through trips."

9. Calculate mode split for "to" trips and "through" trips after improvements.

Corridor Service Summary

Before discussing the results, it is appropriate to summarize the highway and transit services available in each corridor and to provide a brief description of the Central Artery/Third Harbor Crossing Project. These descriptions are given to better appreciate the context of initial mode choice and the mode choice impacts of the proposed highway improvements. Figure 1 summarizes the services available in each corridor.

Corridor	Highway	Public Transportation: Commuter Rail	Public Transportation: Rapid Transit	Public Transportation: Express Bus
Northeast	Sumner Tunnel Mystic Bridge	Rockport Ipswich	Blue Line	2-T Lines
North	I-93 Rutherford Avenue McGrath Avenue	Reading Haverhill Lowell Woburn	Orange Line Green Line	9-T Lines 7 Private Operators
Northwest	Longfellow Bridge Massachusetts Avenue Bridge	Bedford Acton	Red Line	No Service
West	Storrow Drive Commonwealth Avenue Massachusetts Turnpike	Framingham	Green Line	4-T Lines 1 Private Operator
Southwest	Albany Street Washington Street Tremont Street Columbus Avenue	Needham Franklin Attleborough Stoughton	Orange Line	7 Private Operators
Southeast	Southeast Expressway	No Service	Red Line	15 Private Operators

As shown in Figure 1, the northeast corridor has good service. It is served by Routes 1 and 1A with easy access to I-93 in the adjoining north corridor. Public transit has two commuter rail lines, one to Rockport and the other to Ipswich. The rapi transit Blue Line and two MBTA express buses serve this corridor.

The north corridor has even better service. Route I-93 provides the main highway access into the CBD. There are also fou commuter rail lines in addition to nine MBTA express bus routes and seven express services provided by private operators.

The northwest corridor does not have the most direct highway access into the CBD. Many trips from this corridor find it more convenient to use I-93, or the Massachusetts Turnpike, in the adjacent corridors rather than use Soldiers Field Road, Storrow Drive, or Memorial Drive for access to the CBD. There are commuter rail lines to Bedford and Acton. The Red Line provides rapid transit service in this corridor. Express bus service is minimal, using either I-93 or the Massachusetts Turnpike to access the CBD.

The west corridor has good highway service to the downtown area with the Massachusetts Turnpike. There is a commuter rail line to Framingham. The Green Line provides rapid transit service in the corridor with multiple branches to Boston College, Cleveland Circle, Riverside, and Forest Hills. There is express bus service in the corridor with four MBTA bus lines and one private operator. Most express buses travel into the CBD via the Massachusetts Turnpike.

The southwest corridor has no direct highway access into the downtown area. Generally, trips coming into the CBD use loca streets, such as Washington and Tremont streets or access the in a circuitous fashion by Massachusetts Turnpike or the Southeast Expressway. Commuter rail services the corridor wi lines to Franklin, Providence, and Stoughton. The Orange Lin provides rapid transit service in this corridor. There are s operators providing express bus service.

The southeast corridor has good service to the CBD by highway and by transit. The Southeast Expressway provides the main highway access into the downtown area. The Red Line is the major feeder into the CBD from Mattapan and Braintree on the South Shore. There is no commuter rail service but there are fifteen private carriers providing express bus service.

Descriptive Summary of Alternative 5A Modified

Alternative 5A Modified, the preferred alternative, includes major changes to the highway system. With a Third Harbor Crossing, capacity for harbor crossings is increased by 50

percent with two lanes provided each for northbound and southbound travel. The tunnel provides a Seaport Access Road alignment through South Boston and enters East Boston at Jeffrey's Point near Logan Airport.

In Alternative 5A Modified, the northbound Central Artery splits from its present alignment at a point just south of the Massachusetts Turnpike interchange, follows Fort Point Channel, and reconnects with its present alignment north of Northern Avenue. For this stretch of highway, the Artery has four lanes. From just north of Dewey Square to Charlestown, the Artery's capacity is increased by the addition of one to two lanes. The Central Artery Bridge will have five lanes in each direction.

Southbound, from the Artery Bridge to the Dewey Square Tunnel, the Central Artery has one to two additional lanes. In the split alignment, the Central Artery utilizes both the northbound and southbound barrels of the Dewey Square Tunnel giving this section of highway five total lanes southbound.

Under the Alternative 5A Modified scheme, there are no connections between the Central Artery northbound and Callahan Tunnel or between the Sumner Tunnel and Artery southbound. Trips presently using these connections, will, in the future, use the new Harbor Crossing. Similarly, the Third Harbor Crossing does not provide direct access to or from the north in downtown Boston.

Analysis of Results

Base Case Mode Choice

In the AM peak period Base Case, the regional mode split for trips to the CBD is 44 percent auto and 56 percent transit. This indicates that transit is generally the preferred mode choice for trips "to" the CBD. For trips "through" the CBD, the regional mode split of 84 percent auto and 16 percent transit suggests that auto is generally the preferred mode choice for these trips. These mode choices, however, vary by both degree and corridor (see Figure 2).

For "to" trips, the northeast, north, and southeast corridors show a mode split of roughly 60 percent/40 percent in favor of transit. In the northwest, however, where the mode split is 52 percent/48 percent, the mode preference is almost evenly split with a slight preference of auto. The reason for this is that transit provides somewhat less service in the northwest corridor. There are only two commuter rail lines and limited bus and rapid transit service. This might be expected to change once the Red Line extension is opened. In the west corridor, the mode split is 60/40 in favor of auto trips. The reason for this appears to be that the Massachusetts Turnpike provides good highway service

FIGURE 2

ALTERNATIVE 5A MODIFIED HIGHWAY IMPROVEMENT IMPACT ON MODE CHOICE BY CORRIDOR

During the AM Peak Period

Corridor	Mode Split Before Improvements To The CBD	Mode Split Before Improvements Through CBD	Mode Split After Improvements To the CBD	Mode Split After Improvements Through CBD	Mode Split Percentage Change To the CBD	Mode Split Percentage Change Through CBD
Northeast						
Highway	.43	.86	.47	.87	+.04	+.01
Transit	.57	.14	.53	.13	-.04	-.01
North						
Highway	.39	.86	.43	.89	+.04	+.03
Transit	.61	.14	.57	.11	-.04	-.03
Northwest						
Highway	.52	.85	No Change		No Change	
Transit	.48	.15	No Change		No Change	
West						
Highway	.60	.93	No Change		No Change	
Transit	.40	.07	No Change		No Change	
Southwest						
Highway	.23	.62	.23	.62	.00	.00
Transit	.77	.38	.77	.38	.00	.00
Southeast						
Highway	.45	.82	.46	.82	+.01	.00
Transit	.55	.18	.54	.18	-.01	.00
Total						

to the CBD. The southwest corridor has a mode split of 23 percent/77 percent in favor of transit. This underlines the poor access to the CBD by auto in this corridor.

For "through" trips, the overwhelming preference in all corridors except the southwest is auto. Where the other corridors show an average mode split of 90/10 for "through" trips, the southwest is about 60/40.

Mode Choice Impacts

The highway improvements show a mode choice impact for the region of two percent change to auto for "to" trips and a one percent change to auto for "through" trips. The mode choice impacts differ by degree and by corridor, and these differences are discussed in the following section. The discussion will summarize, by corridor, the number of transit trips diverted and relate these diversions to specific mode choices and "to" or "through" destinations. Figure 2 summarizes the mode choice impacts of the proposed highway improvements. Figures 3-6 show the specific numbers of trips diverted by corridor.

The northeast corridor is expected to lose a total of 858 trips from rapid transit and commuter rail to auto (see Figure 3).

FIGURE 3

EXPECTED TRANSIT TRIPS DIVERSIONS IN
ALTERNATIVE 5A MODIFIED: NORTHEAST CORRIDOR

Corridor: Northeast	To CBD	Through CBD	Total
Diverted AM Trips			
o Rapid Transit Trips	530	133	663
o Commuter Rail Trips	195	-	195
o Express Bus Trips	-	-	-
o Total Transit Trips	725	133	858

This is because highway travel times inbound are reduced on the Mystic Bridge and Sumner Tunnel. For "to" trips, this corridor shows a loss of 530 rapid transit and 195 commuter rail trips or a change in mode choice of 4 percent due to improvements. Since the "to" trips are more likely to be made by transit, this is where the greatest impact on mode choice will occur. For "through" trips, the northeast corridor shows a loss of 133 rapid transit trips or only a one percent highway gain in trips. Considering the 86/14 split before improvements and the fact that

the Blue Line is not really a through service line, this small shift is not surprising. Express bus service in this corridor s not expected to be affected because buses use the Mystic Tobin Bridge for which they will enjoy the same decrease in travel times as auto.

The north corridor is expected to lose 1,645 trips from t combined Orange and Green lines, commuter rail, and express bu (see Figure 4).

FIGURE 4

EXPECTED TRANSIT TRIPS DIVERSIONS IN ALTERNATIVE 5A MODIFIED: NORTH CORRIDOR

Corridor: North	To CBD	Through CBD	Total
Diverted AM Trips			
o Rapid Transit Trips	928	378	1,306
o Commuter Rail Trips	267	-	267
o Express Bus Trips	72	-	72
o Total Transit Trips	1,267	378	1,645

For "to" trips, rapid transit and commuter rail are expected to lose 1,195 trips to auto. This shift is expected to occur because of reduced auto travel times inbound on I-93. Express bus in this corridor will lose 72 trips because of the necessary elimination of the I-93 carpool lane. After the lane is closed buses will lose the present time advantage over autos.

The north corridor "through" trips for highways shows a three percent shift from transit or a loss of 378 transit trip to auto. Since this corridor has the Orange and Green lines which do serve areas beyond the CBD, in addition to sixteen express bus lines, it can be expected that highway improvement will have a greater impact on mode choice in this area than in other corridors which show a one percent shift or no impact on mode choice for "through" trips.

The northwest and west corridors are not affected by any travel time gains accrued from the Third Harbor Crossing or improvements on the Artery.

The southwest corridor shows negligible impact on mode choice because improvements on the Artery or the Harbor Crossi do not directly affect this corridor (see Figure 5).

FIGURE 5

EXPECTED TRANSIT TRIPS DIVERSIONS IN
ALTERNATIVE 5A MODIFIED: SOUTHWEST CORRIDOR

Corridor: Southwest	To CBD	Through CBD	Total
Diverted AM Trips			
o Rapid Transit Trips	-	-	-
o Commuter Rail Trips	-	-	-
o Express Bus Trips	-43	-5	-48
o Total Transit Trips	-43	-5	-48

No losses on commuter rail or rapid transit are expected because the improvements are expected to have minimal impact on auto travel times "to" and "through" the corridor. Express bus service, however, will show a gain of 43 "to" trips and 5 "through" trips. This is because travel times relative to auto will improve in this alternative with the exclusive bus lanes from the Massachusetts Avenue interchange to South Station. The shift in bus ridership is negligible enough that, overall, this corridor shows no impacts on mode choice.

The southeast corridor shows a total net loss of 647 trips for all transit trips (see Figure 6). This net loss represents

FIGURE 6

EXPECTED TRANSIT TRIPS DIVERSIONS IN
ALTERNATIVE 5A MODIFIED: SOUTHEAST CORRIDOR

Corridor: Southeast	To CBD	Through CBD	Total
Diverted AM Trips			
o Rapid Transit Trips	711	237	948
o Commuter Rail Trips	-	-	-
o Express Bus Trips	-301	-	-301
o Total Transit Trips	410	237	647

both a gain and a loss for "to" transit trips. The Red Line is expected to lose 711 "to" trips. This loss will be offset by a

gain of 301 express bus "to" trips resulting in a 410 net loss for "to" trips. It is expected that the Red Line will lose 237 "through" trips as a result of the proposed Alternative 5A high way improvements. The gain in bus trips compared with the loss for rapid transit trips can be explained by the fact that the Southeast Expressway will have a contraflow lane. With this lane, buses will enjoy even more travel time savings benefits than auto. The increase in express bus ridership resulting fro these time savings will partly offset the 711 trip loss that is anticipated on the Red Line.

Conclusion

It might have been expected that a multi-billion dollar pr-ject, affecting the regional highway network for many, many yea to come, would have a substantial impact on mode choice. But, from this analysis, it is evident that the highway improvements proposed in this alternative have minimal impacts for both "to" and "through" trips and these effects are only in a few corridors. This clearly points out the distinctive and separate rol of highway and transit in the context of regional mode choice f travel. Transit primarily serves trips "to downtown" while hig-ways mostly serve "through downtown" trips. These roles do not change with the construction of highway improvements, even majo ones. Thus, benefits accrued by the proposed improvements will mostly affect highway users.

This underscores the role of the Central Ar-ery as a regional facility. According to the 1977 Origi -Destination Survey, 65 percent of trips crossing the downto- cordon line a "through" trips. The figure for vehicles that e-ter and use th Central Artery is 76 percent.[2] This is a sign-icant change from the first Origin-Destination Survey done i 1945 when only 15 percent of trips were through trips. The main -unction of the downtown highways then was that of local distri-ution facilitie to service the downtown area. The Origin-Destination Survey results clearly show that the highway system today in the CBD i oriented for through trips and not local trips.

MD:sb

[2]Boston Central Artery 1977 Origin-Destination Study, page 2. Commonwealth of Massachusetts, Executive Office of Transportation and Construction, the Massachusetts Department of Public Works, United States Department of Transportation, a the Federal Highway Administration, and Tippets-Abbot-McCarthy-Stratton.

CTPS

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MEMORANDUM

TO : Central Artery/Third Harbor Crossing Files September 23, 1983

FROM: Cathy Buckley

SUBJ: Induced and Converted Traffic, AWDT

Executive Summary

Research done nationally indicates that new facilities may or may not induce traffic. A major conclusion of that research is that if a facility is acting as a bottleneck, then the relief of that bottleneck might induce additional trips. Given that the Central Artery and the cross-harbor tunnels are bottlenecks, there is the potential for induced traffic.

For this project, the only difference between the Build and No-Buil- highway trip tables is the number of trips forecast for Logan rport. Therefore, this analysis is aimed at determining both i uced traffic and traffic converted from or to other modes, or the area excluding Logan Airport.

E studying the relationship between Logan and non-Logan traffi in the tunnels, an estimate was made of potential induced and cc erted traffic. There was insufficient information for such a estimate for new Central Artery capacity. Qualitatively, however, it appears that the potential induced and converted traffic due to additional Central Artery capacity would be much less than that due to a new tunnel.

The following table indicates the estimated adjustments to be made to the Build and No-Build trip tables, for 1990 and 2010. Also shown for perspective are the differences in the trip tables reflecting assumptions about Logan traffic, and total trips.

	Estimated Adjustments		Existing Logan Adjustments		Existing Total Trips	
	1990	2010	1990	2010	1990	2010
Build	--	+ 7600	--	--	3,424,454	3,580,3?
No-Build	-2600	- 4000	-3200	-12,800	3,421,263	3,567,5?
Differences	2600	11,600	3200	12,800	3,191	12,8?

TABLE 1: AWDT (TWO-WAY), 1990 AND 2010, BUILD AND NO-BUILD TOT TRIPS AND ADJUSTMENTS

As indicated, the difference between the existing Build an No-Build trip tables is the adjustments made for Logan trips. The analysis in this memo suggests that approximately the same adjustment is warranted for non-Logan traffic. As for the overall magnitude, these suggested adjustments would decrease t 1990 No-Build trip table by 0.08 percent, the 2010 No-Build tri table by 0.11 percent, and would increase the 2010 Build trip table by 0.21 percent.

The following table indicates total tunnel AWDT's for 1990 and 2010, Build and No-Build, as well as the maximum percentage change that would be due to the adjustments derived in this memo

	Assigned Tunnel Trips		Maximum Change From New Adjustments	
	1990	2010	1990	2010
Build	83,648	91,821	0.0%	+8.3%
No-Build	111,723	128,546	-2.3%	3.1%

TABLE 2: AWDT (TWO-WAY) TUNNEL TRAFFIC EXISTING ASSIGNMENTS AN MAXIMUM PERCENTAGE CHANGE FROM NEW ADJUSTMENTS

These changes are termed maximum because some of the delete or added trips may not come from the tunnel crossings but from the Tobin Bridge or points even further west.

CB/mh

I. Introduction

A simple explanation of the traffic forecasting done for the Central Artery/Third Harbor Crossing analysis is as follows. A first step is to break down the metropolitan area into zones, where a zone might represent a Boston neighborhood, a municipality, or a point on the circumference of the region. A next step is to develop a zone-to-zone trip table, or matrix. This matrix describes how many motor vehicle trips there are from each zone to each other zone. The sum of all zone-to-zone trips represents all trips made in or through the region. The matrix also includes trips within zones. For this project, trip tables were developed, for the AM and PM peak periods and for Average Weekday Traffic, for the years 1977, 1990, and 2010. The highway trips in the 1977 table were based on historical information. The two future year tables were extrapolations based on population and employment forecasts.

The next step is to assign the trips in the trip table to a highway network. The network is a coded representation either of the existing highway system, in the case of the "No Build" alternative, or of the existing system with proposed changes, for the "Build" options.

The trip tables used for the Build and No-Build assignments differed only in the trips to and from Logan Airport. The tunnels are crucial to Logan access. Given that, it was determined that the absence of a tunnel would affect the way passengers, employees and others would reach the airport. Therefore, separate Build and No Build estimates of highway trips to Logan were made for the years 1990 and 2010.[1]

There is some question, however, as to whether further differences between the Build and No Build trip tables should be introduced.

A. Definitions

When a new facility is built, traffic is attracted to it. That new traffic was defined in one study as being from six possible sources:[2]

1. Diverted Traffic - Trips currently being made on other streets and highways that will be diverted to the new, or improved, facility.

2. Converted Traffic - Trips currently being made on other modes of transportation that will be converted to the new facility.

3. Growth Traffic - Increased volumes of traffic due to population growth of the urban area - with the increas population exhibiting the same average trip generation rates.

4. Developed Traffic - Increased traffic volumes due to changes in the land use within the travel corridor served by the new facility. This is an element of growth traffic, but it is of such a unique nature in relationship to the new facility that it merits specif identification.

5. Cultural Traffic - Changes in traffic resulting from a change in propensity for travel due to socioeconomic characteristics of the population. This traffic is similar in nature to and is often included with growth traffic. Cultural traffic, however, results from changes in customs, cultural habits, and life styles which influence the number of trips made by each perso

6. Induced Traffic - New trips that are made because of t added convenience afforded by the new facility (increased accessibility).

In the traffic assignment model for the Central Artery/Thi Harbor Crossing, traffic in the No Build case is based on growt as well as developments anticipated in East and South Boston. the Build options, the traffic assignments include diversions from other routes and Logan traffic converted from other mod .

What was not considered was induced traffic, or highway trips that would be made if and only if the new highway faci - ties under consideration were to be built. Furthermore, the option of trips being converted to or from other modes was o considered in regard to Logan.

The concept that is of concern in this memo is the difference between the number of trips that would be made under No Build conditions versus a Build scenario. (For the Build scenario, the preferred Alternative 5A 7, a Depressed Central Arte and new tunnel to Logan Airport, will be used.) That number m include estimates of converted traffic as well as induced traffic, as defined above. There was no attempt in the traffic for casting procedures, and there will be none here, to deal with t concept of cultural traffic.

B. Other Studies

A literature review was undertaken to see what has been learned about the concept of induced traffic. According to the studies surveyed,[3] it is difficult to quantify the induced traf fic expected for a given new facility.[4] In some cases, a new

facility did not create induced traffic; in others, it did. There are two factors that seem necessary for significant induced traffic to occur. These factors are (1) that the new facility creates a major change in accessibility and (2) that the existing facilities are acting as a bottleneck.[5] A major change in accessibility was defined as when the off-peak travel time was decreased significantly by the new facility.

Section II of this memo will discuss the impact of a new tunnel on total highway trips in the region. Section III will focus on the new Central Artery.

II. Third Harbor Crossing

As indicated above, the impact of a new tunnel on mode split to Logan Airport was explicitly addressed. This section analyzes the impact of a new tunnel on the non-Logan trips across the harbor by looking at historic trends in cross-harbor traffic and the relationship between Logan and non-Logan traffic.

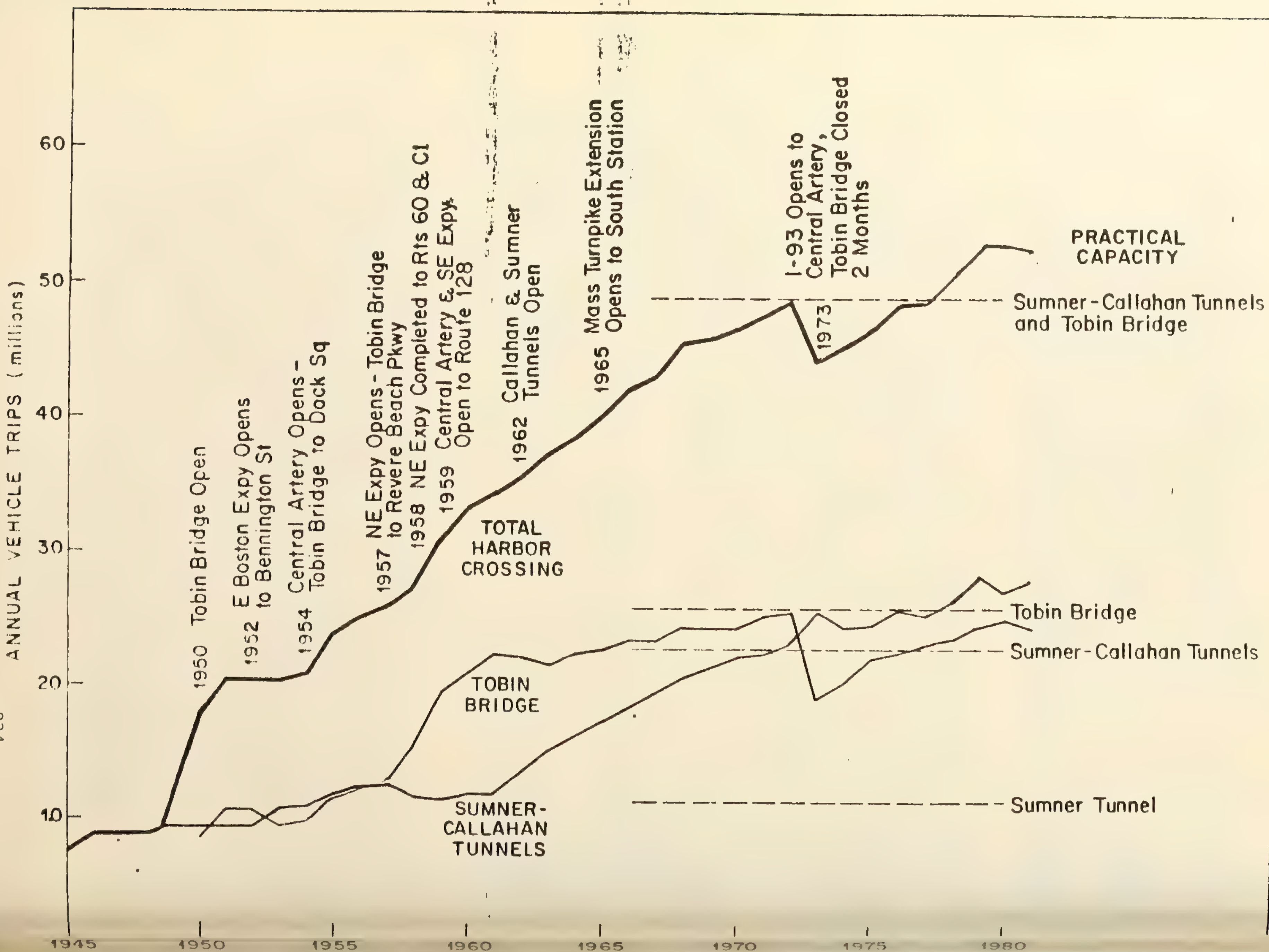
A. Harbor Crossings: Historical Perspective

The Sumner Tunnel was opened in 1934, the Tobin (Mystic River) Bridge in 1950, and the Callahan Tunnel in 1962. Figure 1 shows traffic trends in the tunnels and on the bridge from 1945 to 1981.[6]

Also indicated is the practical capacity of the various facilities. The practical capacity, as defined by Coverdale and Colpitts, is reached when traffic in the peak direction moves under forced-flow conditions for the peak hour only. Additional traffic leads to the lengthening of peak periods and more traffic in off-peak hours.[7]

Tom Lisco describes the trends from 1945 to 1973 as follow :[8]

> As shown in the figure, early post-war traffic through the Sumner Tunnel amounted to somewhat less than the tunnel's practical capacity. When the Tobin Bridge opened in 1950, there was little effect on Tunnel traffic, and traffic on both facilities grew until the mid 1950's, when the Sumner Tunnel began to operate at somewhat above practical capacity. From that time until 1961, all growth on the two facilities took place on the Tobin Bridge. This growth was rapid, aided by progressive opening of various segments of the Northeast Expressway, the Central Artery, and the Southeast Expressway. Traffic in the tunnel could not grow substantially because the tunnel was already operating at somewhat above practical capacity.


ANNUAL VEHICLE TRIPS (millions)
60
50
40
30
20
10
1945
1950
1955
1960
1965
1970
1975
1980
1950 Tobin Bridge Open
1952 E Boston Expy Opens to Bennington St
1954 Central Artery Opens - Tobin Bridge to Dock Sq
1957 NE Expy Opens - Tobin Bridge to Revere Beach Pkwy
1958 NE Expy Completed to Rts 60 & C1
1959 Central Artery & SE Expy Open to Route 128
1962 Callahan & Sumner Tunnels Open
1965 Mass Turnpike Extension Opens to South Station
I-93 Opens to Central Artery, Tobin Bridge Closed 2 Months
1973
PRACTICAL CAPACITY
Sumner-Callahan Tunnels and Tobin Bridge
Tobin Bridge
Sumner-Callahan Tunnels
Sumner Tunnel
TOTAL HARBOR CROSSING
TOBIN BRIDGE
SUMNER-CALLAHAN TUNNELS

In 1962, the situation changed dramatically. The Callahan Tunnel was opened and the practical capacity of tunnel harbor crossings was doubled. For this reason, and because of rapid air travel growth at Logan Airport, the next ten years saw most of the traffic growth take place in the tunnels. By the early 1970's, both the bridge and the tunnels were operating near their practical capacities and total cross-harbor traffic growth was slowing.

In 1973, two major developments took place. The first was that in September, 1973, an overloaded truck hit a Tobin Bridge column. The resulting structural damage caused the bridge to be closed for two months. The second development was that the day the accident took place, I-93 was opened north from Charles River Bridge. Initially, a substantial amount of traffic diverted from the bridge to I-93 and the tunnels because of the bridge closure. But, even after the bridge was reopened, bridge volumes were reduced from what they had been previously. This was because I-93 offered a better route for some drivers who had previously used the bridge.

Since 1973, most of the cross-harbor traffic growth occurred on the Tobin, which did not exceed practical capacity until 1978, rather than in the tunnels, which exceeded practical capacity in the early '70's.[9]

Although the Tobin Bridge had not reached practical capacity before 1978, it did (and does) experience delays caused by the Central Artery Charles River Bridge bottleneck.[10] Therefore, the Tobin Bridge is not able to handle even the limited additional traffic that Figure 1 suggests.

B. Existing Tunnel Traffic

Traffic in the Sumner and Callahan Tunnels can be broken into two categories that act very differently from each other. The categories are (1) traffic going to and from Logan Airport, and (2) all other tunnel traffic.

Figure 2 indicates tunnel traffic from 1960 through 1981, by total and by the Logan and non-Logan compontents.[11] Non-Logan traffic increased substantially from 1960 to 1973. During that period, Logan-related traffic grew even faster. In 1973, the practical capacity of the Sumner-Callahan tunnels was reached.

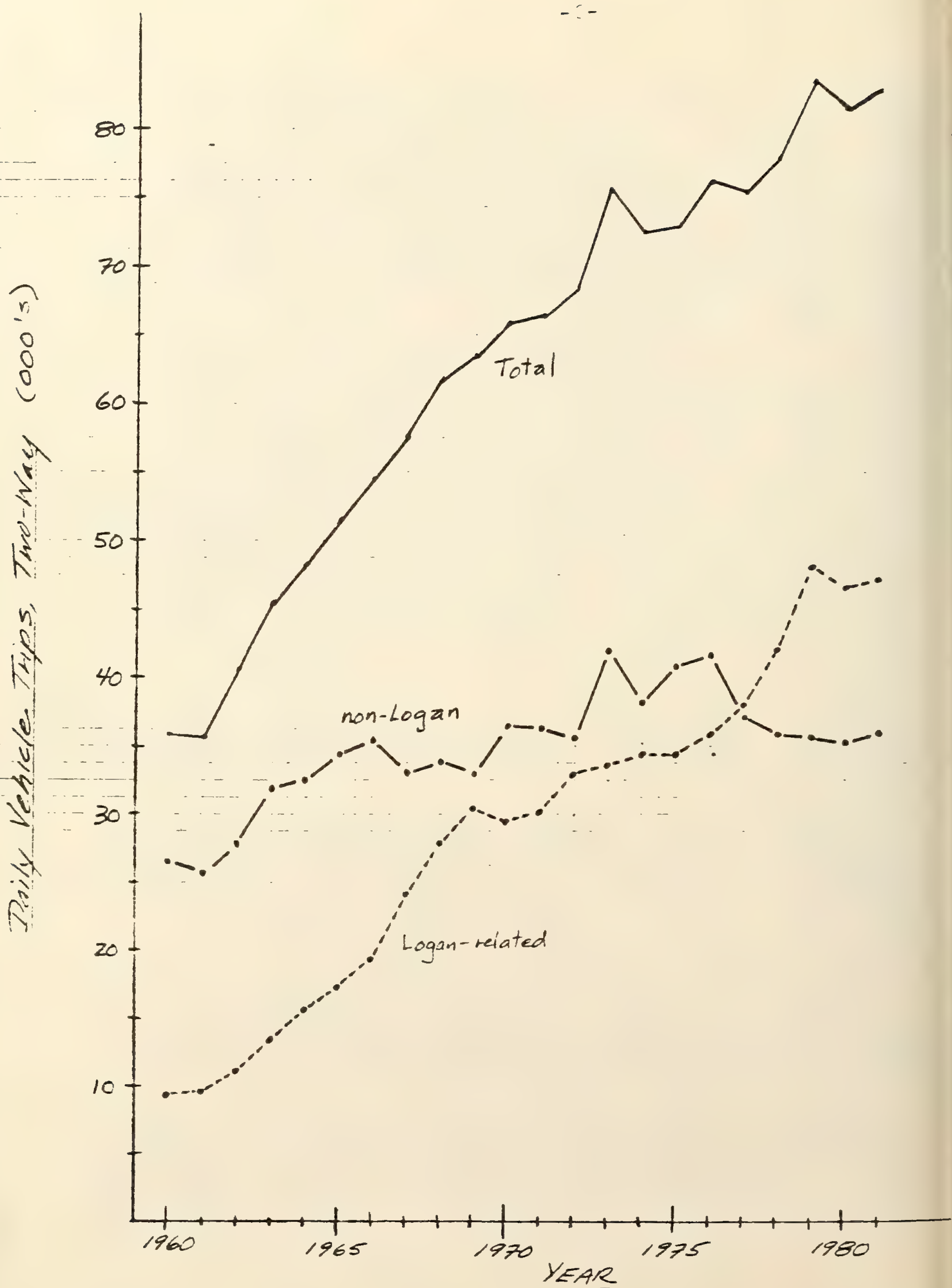


FIGURE 2 Tunnel Traffic, Two-Way Daily Trips with Logan, non-Logan components

Since then, non-Logan tunnel traffic has not only stopped increasing, but had declined by 1981 to almost the level found in the mid-1960's. Logan-related tunnel traffic, on the other hand, continued increasing beyond 1973 to 1979, and experienced a slight decline thereafter, due to decreased enplanements.

Logan-related traffic is squeezing non-Logan traffic out of the tunnels. This phenomenon is occurring because cross-harbor traffic destined for Logan has little alternative to the tunnels. Also, the majority of traffic destined for Logan consists of private vehicles and taxis either driven by or carrying air passengers. These passengers do not use Logan on a daily basis and have less incentive to find an alternative route than if they are daily commuters.

Table 3 presents information on the Logan and non-Logan traffic components in the tunnels from 1957 through 1981. Column 1 indicates the volume change by year for Logan and non-Logan trips. While the Logan component increased every year except three, the non-Logan traffic moves from increases to decreases with no discernible pattern. Column 2 shows the same information using a five-year moving average which smooths out the data.[12] The pattern is much clearer in Column 2: Logan traffic increasing steadily, non-Logan traffic decreasing just before the Callahan opened in 1962, and again since the mid-1970's. (Although the non-Logan value does not return to the negative column until 1978, that 1978 value includes 19174-1978 data.)

To estimate the effect of future Logan traffic on tunnel traffic, it is necessary to establish a relationship between Logan and non-Logan tunnel traffic. That is, for every Logan trip added to the tunnel, what happens to non-Logan tunnel volumes? Column 3 indicates the number of non-Logan trips added (or subtracted) for each additional Logan trip, by year (based on the five-year averages). Looking at the last four values, the range of non-Logan trips displaced for each new Logan trip varied from 0.18 to 0.71. These values are in turn smoothed out in Column 4 using a three-year weighted average.[13] From 1978 to 1980, the weighted average increased from 0.12 to 0.27 to 0.35 non-Logan trips displaced per new Logan trip (based on data from 1974 on) and stabilized at that level in 1981. At this point, there is a loss of approximately one-third of a non-Logan tunnel trip per additional Logan tunnel trip.

C. Potential Decreases in Non-Logan Tunnel Traffic

It is difficult to know whether non-Logan traffic would continue to be discouraged at the same rate as has recently been experienced. As congestion increases, it is conceivable that non-Logan traffic would be discouraged at a faster rate than occurs now. On the other hand, the non-Logan "survivors" may

	1 Volume Change from Previous Year				2 Average Volume Change for 5 Years				3 New Non-Logan Trips per New Logan Trip (Based on 5 Year Averages)		4 3 Year Weighted Average New Non-Logan Trips per New Logan Trip (5 Yr Ave)	
	Logan		Non-Logan		Logan		Non-Logan					
	+	−	+	−	+	−	+	−	+	−	+	−
1957	1094			622								
1958	331			3797								
1959	1200			2094								
1960	362		1724									
1961	627			810	723			1120		1.55		
1962	1356		3505		775			294		.38		
1963	2378		2599		1185		985		.83		.03	
1964	2011		738		1347		1551		1.15		.79	
1965	1624		1586		1599		1524		.95		1.00	
1966	2080		1197		1890		1925		1.02		1.02	
1967	4947			1971	2608		830		.32		.66	
1968	3609		548		2854		420		.15		.35	
1969	2529			942	2958		84		.03		.12	
1970		821	3304		2465		427		.17		.12	
1971	549			50	2163		78		.08		.10	
1972	2853			674	1744		437		.25		.18	
1973	721		6327		1166		1593		1.37		.78	
1974	651			3648	791		1052		1.33		1.16	
1975		1241	1627		707		716		1.01		1.18	
1976	2794		389		1156		804		.70		.91	
1977	2187			2925	1022		354		.35		.58	
1978	4161			1527	1710			1217		.71		.12
1979	5660			68	2712			501		.18		.27
1980		1338		615	2693			949		.35		.35
1981	510		764		2236			874		.39		.34

have, or perceive themselves to have, fewer options to driving through the tunnel and may, therefore, hang on more tenaciously. Given the information available, the most reasonable course is to assume the present non-Logan discourgement rate will continue into the future.

Under the No-Build scenario, how much non-Logan traffic would be discouraged by 1990 and 2010? For 1990, under No-Build, Logan Airport is forecast to attract an AWDT of 42,100, an increase of 9,550 trips over 1977.[14] By 2010, the Logan No-Build AWDT is forecast to be 51,500, an increase of 9,400 over the 1990 forecast.[15]

Traffic counts done by Massport in 1979 found that 58 percent of the traffic entering Logan did so from the Callahan tunnel off-ramp.[16] If that rate continues, then 58 percent of the 9,550 new Logan trips by 1990, or 5,500 trips, will use the tunnel.

If each of these 5,500 Logan tunnel trips displaces one third of a non-Logan trip, a total displacement of about 1,800 trips will occur. Between 1990 and 2010, 58 percent of the additional 9,400 Logan trips, or 5,500, would use the tunnel, displacing another 1,800 non-Logan trips. The net increase of 7,400 trips is 20 percent more than the 1977 Callahan tunnel AWDT of 37,100. The total 2010 Callahan tunnel forecast is 44,500 vehicles (37,100 plus 7,400). The absolute hourly capacity of the tunnel is 3,100 vehicles. The tunnel could accommodate an AWDT of 44,500 by operating at absolute capacity for over fourteen hours per day.

In total, by 2010, approximately 3,600 fewer non-Logan trips and 11,000 more Logan trips would be made in each tunnel than occurred in 1977.

D. <u>Potential Increases in Non-Logan Tunnel Traffic</u>

The other component of traffic of interest here is that non-Logan traffic that would be <u>added</u> every year if there were no tunnel capacity constraint. A useful period to look at to see non-Logan traffic growth is during the decade beginning in 1962 when the tunnels did not constrain traffic.

The tunnel capacity constraint was eliminated in 1962 with the opening of the Callahan tunnel. The period from 1964 to 1970 will be used, avoiding 1962-1963, when pent-up, non-Logan demand from previous years was probably satisfied. The analysis period is ended in 1970, just before practical capacity of the tunnels was reached.

From 1964 and 1970 inclusive, according to the data in Tabl 1, 4,460 non-Logan trips were added to the two tunnels, or an AWDT of about 2,230 in each tunnel. This averages to an AWDT of about 300 trips per tunnel per year.

The growth of non-Logan traffic assumed in the Central Artery/Third Harbor Crossing analysis can be determined by looking at selected portions of the trip tables. That is, the origin zones are defined as the North Shore, except Logan Airport, while the destination zones are defined as Boston (except East Boston) and points south. The results are shown below:

Year	One-Way AWDT	Difference from Previous Listing	Number of Additional Trips per Year
1977	26,790		
1990	28,838	+2,048	157
2010	29,364	+ 526	26

TABLE 4: TOTAL TRIPS (AWDT), NORTH SHORE EXCEPT LOGAN ACROSS HARBOR TO BOSTON AND POINTS SOUTH

According to these figures, between 1977 and 1990, an additional average of 157 non-Logan trips per year would be likely t use the tunnel, and an additional 25 per year from 1990 to 2010.

It should be noted, however, that the relationship between trip-making and population/employment in the trip tables reflect conditions in 1977. By 1977, the Sumner-Callahan tunnels had been operating above their practical capacity for seven years (see Figure 1). The trip tables, therefore, reflect a future that includes a significant cross-harbor capacity constraint.

E. Population

As indicated above, trip tables for 1990 and 2010 are based on population and employment forecasts. It is interesting to look at the forecasts for population growth for the North Shore area and compare that to past growth.

During the 1960's, the population of East Boston and ten inner North Shore communities increased by 15,750 (see Table 5). The population of the seven North Shore communities further out increased a total of 1,200. The average yearly population increase from 1960 to 1970 for East Boston and the seventeen North Shore communities was 275 people.

TABLE 5

Past and Projected Populations, North Shore

Community	U.S. Census 1960	U.S. Census 1970	U.S. Census 1977*	Projections 1990	Projections 2010
Inner					
East Boston	43809	38873	34194	29500	29000
Revere	40080	43159	42643	42400	42400
Winthrop	20303	20335	19606	18200	17900
Chelsea	33749	30625	26989	24000	23600
Saugus	20666	25110	24855	24700	24700
Lynn	94478	90294	82017	74000	72800
Nahant	3960	4119	3998	3900	3900
Swampscott	13244	13578	13759	13800	13800
Salem	39211	40556	38920	38200	38200
Marblehead	18521	21295	20476	20100	20100
Peabody	32202	48080	46607	46000	46000
Subtotal	360273	376024	354064	334800	332400
Outer					
Beverly	36108	38348	37862	37700	37700
Danvers	21926	26151	24715	24100	24100
Middleton	3718	4044	6783	7000	7000
Topsfield	3351	5225	5342	5400	5400
Wenham	2798	3849	4107	4100	4100
Hamilton	5488	6373	5563	5700	5700
Manchester	3932	5151	3882	3900	3900
Subtotal	77321	89141	88254	87900	87900
TOTAL	437594	465165	442318	422700	420300
change from previous column		+6.3%	-4.9%	-4.4%	-0.6%
average change per year		+0.6%	-0.7%	-0.3%	0.0%

* interpolation between 1970 and 1980 U.S. Census Data

By contrast, the same area is forecast to experience a pop-lation loss of almost 20,000 people between 1977 and 1990, or 1,500 per year. Between 1990 and 2010, a population decrease c 2,400 is predicted, or 120 people per year.

It is probable that future population levels on the North Shore would be affected by a new tunnel crossing. And while th population forecasts here probably underrepresent the growth tc be expected with a new tunnel, that growth would be probably mu less than that experienced in the 1960's. There are many other factors influencing this growth, among which are the birth rate general economic conditions, and conditions here relative to other parts of the country.

A similar though somewhat more involved discussion could b had concerning employment.

F. No-Build Alternative

If no new Third Harbor Crossing is built, then, by making series of assumptions, an estimate can be made of whether the N Build trip tables reasonably reflect future expectations.

The first assumption is that Logan traffic will continue t discourage non-Logan traffic from the tunnels at the rate of on third non-Logan trip per new Logan trip. The number of trips that will not be accommodated in the tunnel is, therefore, the discouraged non-Logan trips plus the anticipated growth of non-Logan tunnel trips, both of which were developed above for 1990 and 2010.

Non-Logan Tunnel Traffic	1977-199	Period 1990-2010	Total
Discouraged by logan trips	1,800	1,800	3,600
Anticipated increases due to growth	2,000	500	2,500
TOTAL	3,800	2,300	6,100

TABLE 6: UNMET FUTURE NON-LOGAN TUNNEL DEMAND, NO BUILD

The above numbers also assume that all growth-related trips bet-ween the North Shore and points south would prefer to use the tunnel.

These trips that cannot be accommodated by the existing tun nels average about 275 per year from 1977 to 1990 and 125 per year from 1990 to 2010. The options available to the drivers of these vehicles are the following: (1) use a different mode, (2) use a different route, (3) do not make the trip.

Figure 4 shows past ridership levels on the Blue Line and he Eastern Line of the commuter rail system. Shown for comarison purposes is ridership on the entire MBTA system. As seen n the figure, MBTA ridership has been trending down, with slight rowth in the mid-1960's and stronger growth from 1975 to 1980.

It is interesting that there does not appear to be a posiive correlation between tunnel congestion and North Shore tranit ridership.[17] Blue Line ridership declined significantly uring the period of cross-harbor congestion before the Callahan unnel opened in 1962. From 1962 until practical capacity of the unnel was reached in 1973, ridership fluctuated in a narrow ange and experienced a net increase. Since 1973, as tunnel ongestion increased again, ridership has decreased signifiantly.

Commuter rail ridership on the Eastern Line, on the other and, has increased steadily since 1976 and over 50 percent verall from 1966 to 1981. Fifteen hundred daily riders were dded between 1972 and 1981. The increasing tunnel congestion in he early 1970's, however, did not result in increased commuter ail ridership.

There is not enough evidence to determine how much of the raffic denied access to the tunnels would divert to other modes, ot make the trip, or change routes. In terms of the accuracy of he No Build trip table, in the "worst" case, the 6,000 trips revented from using the tunnels by 2010 would leave the highway ystem and should, therefore, be removed from the trip table. It s likely, however, that a large number of those 6,000 trips will ivert to other routes and, therefore, remain in the trip tables.

If two thirds of the trips are diverted to other routes and he other one third removed from the highway system, then the 990 No Build trip table contains 1,300 too many trips and the 010 trip table 2,000 too many. There are 26,790 trips going rom the North Shore to points south in the 2010 trip table, so ,000 trips represent 7.5 percent of those trips.

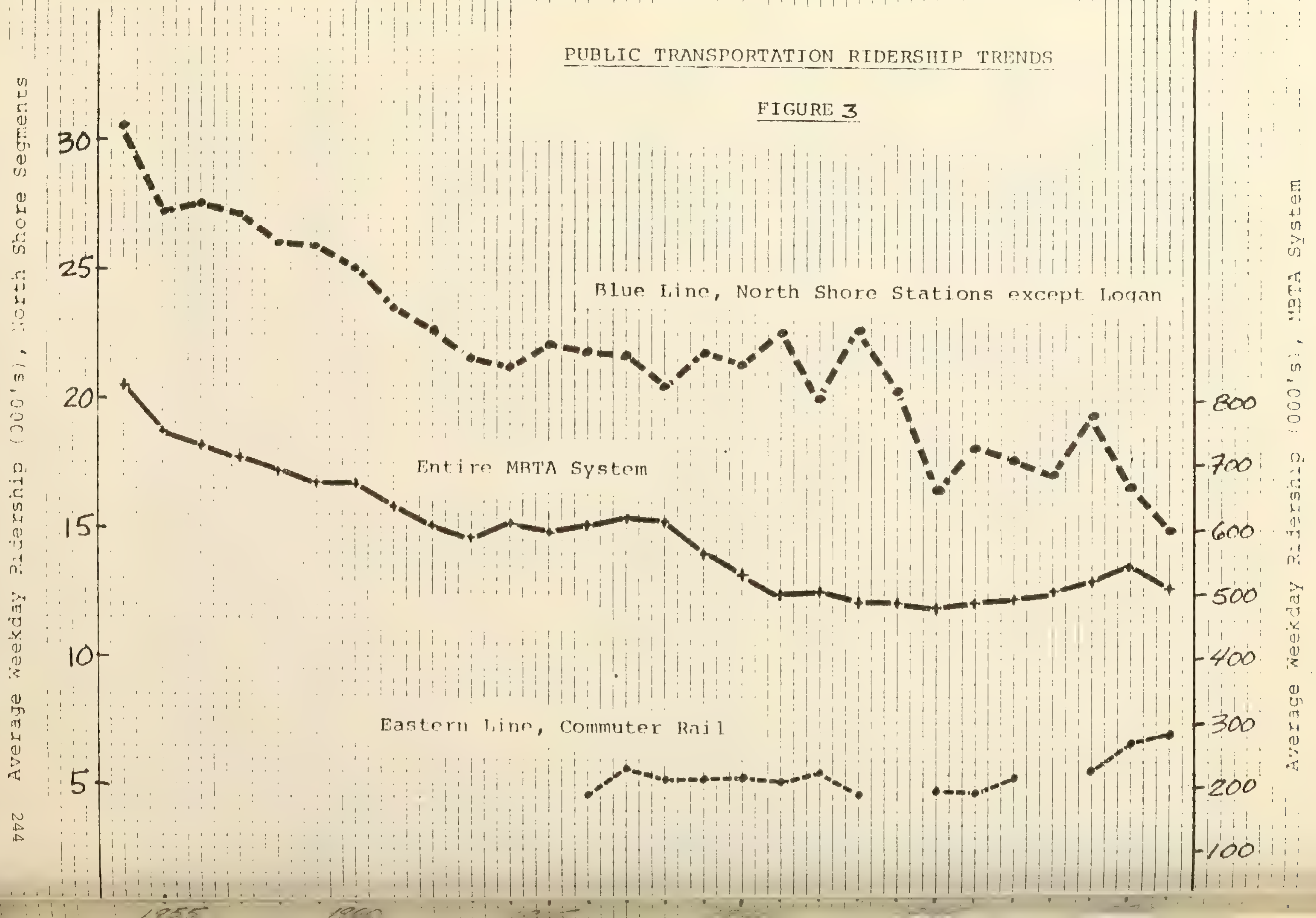
. Build Alternatives

As indicated above, the relationship between trip-making and opulation/employment for the traffic forecasts is based on the 977 situation. By then, the two tunnels had been operating bove practical capacity for five years.

Also, population and employment forecasts take into account ast trends and transportation access. The constraint of crossarbor access has contributed to past growth in and future expecations of population and employment.

PUBLIC TRANSPORTATION RIDERSHIP TRENDS

FIGURE 3



To determine whether more trips should be added to the Build trip tables, it is useful to look at the Logan and non-Logan shares of tunnel traffic, for Build and No Build through future years. This is done in Table 7, which is explained in detail below.

<u>One-Way Traffic in Tunnel(s)</u> (AWDT)

Year	Logan-Related		Non-Logan		Total	
1977	18,879		18,259		37,138	
1989	23,992		16,556		40,548	
Year	Build	No Build	Build	No Build	Build	No Build
1990	25,346	24,418	22,010[1]	16,415	47,356	40,833
2010	33,582	29,875	?	14,596	?	44,471

TABLE 7: <u>LOGAN AND NON-LOGAN SHARES, FUTURE TUNNEL TRAFFIC BUILD AND NO BUILD</u>

[1]Does not include diversions from other routes except denied non-Logan trips from 1977 to 1990.

The Logan share, for all years and alternatives, is derived by assuming 58 percent of the Logan AWDT is from the tunnels. It is assumed that from 1977 to 1989 traffic will increase under No Build assumptions. For Logan traffic, that means a modified mode split, as developed in a previous analysis; for non-Logan, a net loss of one-third trip for each new Logan trip.

In 1990, the figures for No Build are a continuation of the 1977 to 1989 pattern. For Build, changes have been included for the sake of simplicity that would probably take more than one year. For Logan, the mode split reverts to that found in 1979, resulting in 900 more trips. The non-Logan total equals all the North Shore growth trips from 1977 to 1990 (2,048 trips as found above) plus all the non-Logan trips squeezed out by Logan trips between 1977 and 1990 (1,703 trips), added to the 1977 non-Logan total of 18,259. (Not included in the table are non-tunnel trips in the 1977 trip table that would divert to the tunnels in the Build option).

The Build trip table seems fairly reasonable up to 1990. It is from 1990 to 2010 that a modification seems warranted. As mentioned previously, the trip table assumes a growth of only 526 trips from the North Shore to Boston and points south from 1990 to 2010. This is a reasonable assumption for constrained cross-harbor conditions but not for a new tunnel.

Going back to the period when the tunnels were not a constraint (1964 to 1970), non-Logan growth averaged 300 trips per year (one-way AWDT). The non-Logan AWDT during that period was about 33,000, yielding a growth rate of 0.9 percent. If the same compound annual growth rate for non-Logan traffic is assume from 1990 to 2010, then the 2010 non-Logan level would be 26,330 or 4,320 more non-Logan trips than in 1990. Table 3 suggested a non-Logan tunnel traffic growth of 526 trips from 1990 to 2010 i the trip tables. Therefore, an estimate of 3,800 new trips to b added to the 2010 Build trip table seems reasonable.

H. Traffic Assignments

Before moving on to a discussion of the Central Artery, it is interesting to compare the above calculations to the traffic assignments produced by the computer.

2010 One-Way AWDT Tunnel Traffic

	Calculated Above	Machine Assign-ment	Calcula-tion/ Machine	Machine Assign-ment Modified	Calculation/ Modified Machine
No Build	44,471	47,189	0.94	45,189	0.98
Build (5A7)	66,288	64,082	1.03	67,882	0.98

TABLE 8: COMPARISON OF MANUAL CALCULATION TO MACHINE ASSIGNMENT

The results are generally in accord.

III. Central Artery

The split of Logan and non-Logan traffic was a useful handl with which to grasp the concept of induced and converted traffic for a new harbor crossing. No such handle appears to exist for the Central Artery.

Because the Artery is a north-south route, the northern and southern regions are the most critical potential sources of induced traffic. It seems reasonable that additional capacity o the Central Artery would not create more induced or converted traffic than was identified in the previous discussion. The focus of this section then will be on traffic from the south.

The next few sections will describe the history of Southeas Expressway traffic, the Southeast Expressway assignments made by the model, trip table projections from the South Shore to points north, and population projections for the South Shore.

A. Southeast Expressway Traffic Historic Trends

The Massachusetts Department of Public Works maintains a permanent counting station on the Southeast Expressway at Southampton Street (Station 81), relatively close to the southern terminus of the Central Artery. Table 9 indicates two-way, average Daily Traffic (ADT) volumes for that location from 1961 through 1982.

The yearly ADT volumes were smoothed out using a three-year weighted average. The annual change was computed, using the smoothed ADT values (see column 3). As seen in column 2, the growth rates from 1961 through 1965 wre quite high, averaging 6.4 percent. Growth slowed dramatically during the next five years, averaging 1.1. percent. Then a three-year growth spurt averaging 5.1 percent occurred from 1971 through 1973. Interestingly enough, this spurt in highway traffic coincided with the 1971 opening of the South Shore branch of the Red Line.

From 1974 through 1980, annual average growth was 1.1 percent. The 1981 and 1982 volumes show a 3.0 percent annual growth.[19]

B. Southeast Expressway Traffic, Future Assignments

The following table indicates, for the No Build and Build Alternative 5A7, the 1977 base case and projected AWDT volumes on the Southeast Expressway near Southampton Street.

	1977	1990	2010
No Build	139,700	168,000	171,000
Build 5A7	139,700	172,000	172,500

TABLE 10: AVERAGE WEEKDAY TRAFFIC, SOUTHEAST EXPRESSWAY NEAR SOUTHAMPTON 1977, 1990, 2010, BUILD AND NO BUILD OPTIONS

The following table indicates, for the above values, simple annual growth rates.

	1977-1990	1990-2010
No Build	1.6%	0.1%
Build	1.8%	0.0%

TABLE 11: SIMPLE ANNUAL GROWTH RATES, SOUTHEAST EXPRESSWAY ADT

Average Daily Traffic
Southeast Expressway at Southampton Street

Year	ADT (two-way)	ADT, 3 year weighted average	Average of Annual Change	Annual % Change of 3 yr. wt. ave)		
1982	145,610	141900	3.0%	3.1		
1981	141,420	137600		2.8		
1980	132,800	133800		-0.1	3/22/80	Braintree MB station open
1979	135,605	134000		1.9		
1978	115,876*	131500		1.8		
1977	118,513*	129200	1.1%	2.2		
1976	128,200	126400		1.5		
1975	126,393	124500		1.4	2/75	breakdown lan used, peak pe
1974	121,300	122800		-0.7		
1973	125,418	123700		3.4		
1972	122,400	119600	5.1%	4.7		
1971	121,450	114200		7.2	9/1/71	South Shore bra Quincy Center). B line opens
1970	107,400	106500		0.9		
1969	106,150	105500		1.2		
1968	104,250	104300	1.1%	0.3		
1967	105,770	104000		1.8		
1966	101,620	102200		1.2		
1965	103,380	101000		5.4		
1964	101,500	95800		9.1		
1963	92,680	87800	6.4%	5.8		
1962	85,140	83000		5.3		
1961	78,800	78800				
1960	Not available					
1959	Not available					Southeast Expressway opene

TABLE 9: Average Daily Traffic, S.E. Expressway @ Southam
1961-1982

* Major reconstructions caused traffic to divert from the Expressway, primarily to other routes. For purposes of this analysis, these abnormal volumes were factored up to interpolated values between 1976 and 1979.

C Trip Table Projections

As was done for cross-harbor traffic, some of the zones have been selected to analyze traffic patterns. In this case, the zones comprising South Dorchester, Mattapan, Quincy, Milton, and communities south have been set as origin zones. Destination zones include most of Boston and communities north and northwest. The results are shown below for 1977, 1990, and 2010.

	Total Trips	Difference	Change/Year	Percent of Change/Year
1977	98,794			
		10,200	785	0.8%
1990	109,017			
		6,470	325	0.3%
2010	115,486			

TABLE 12: AWDT, ONE-WAY, SOUTH SHORE TO BOSTON AND NORTH

D Population

Table 13 indicates past and projected populations for two Boston neighborhoods and sixteen South Shore communities. The slight projected gain in population for the fourteen southernmost communities is offset by population losses further north. Overall, there is a projected population increase of 0.1 percent from 1977 to 1990 and 0.6 percent from 1990 to 2010.

E Induced Traffic

In reviewing the above traffic, trip-making, and population forecasts, no obvious conclusions about induced traffic come out. While the fact that the Central Artery is acting as a bottleneck is obvious, the induced traffic to be expected from a partial relief of that bottleneck is unclear.

With the construction of a new tunnel, the capacity constraint on the north side of the Artery is reduced. On the southern side, however, the Southeast Expressway would continue to act as a severe constraint. Although there are some arterial alternatives to the Expressway, such as Morrissey Boulevard, they are even now at or near capacity during peak periods.

At present, the Central Artery is a bottleneck for Southeast Expressway traffic. This is particularly apparent in the northbound direction on weekday afternoons. Additional capacity on the Artery will allow better traffic flow on the Expressway. But this relief will probably not be of a magnitude sufficient to induce trip-making from the south. As for converted traffic, the

Past and Projected Populations, South Shore

Community	U.S. Census 1970	1977	1980	Projections 1990	2[illegible]
Inner					
South Dorchester	72449	68320	66550	55300	[illegible]
Mattapan	25150	24635	24414	19900	[illegible]
Milton	27190	26259	25860	25900	[illegible]
Quincy	87966	85709	84743	84700	[illegible]
subtotal	212755	204923	201567	185800	[illegible]
Outer					
Randolph	27035	27863	28218	28200	[illegible]
Braintree	35050	35908	36277	36400	[illegible]
Holbrook	11775	11330	11140	11100	[illegible]
Weymouth	54610	55303	55601	55600	[illegible]
Hingham	18845	19890	20339	22100	[illegible]
Hull	9961	9788	9714	9700	[illegible]
Cohasset	6954	7108	7174	7200	[illegible]
Scituate	16973	17213	17317	17300	[illegible]
Norwell	7796	8766	9182	11100	[illegible]
Hanover	10107	10982	11358	12900	[illegible]
Rockland	15674	15688	15695	15700	[illegible]
Pembroke	11193	12798	13487	16500	[illegible]
Marshfield	15223	19208	20916	23700	[illegible]
Duxbury	7636	10555	11807	14400	[illegible]
subtotal	248832	262400	268225	281900	[illegible]
Total	461587	467323	469792	467700	[illegible]
% change from previous listing		1.2%	0.5%	-0.4%	
change per year		0.2%	0.2%	-0.04%	

Past and Projected Population, South of B[illegible]

Table 13

reliability of the Red Line or the establishment of a contra-flow bus lane on the Expressway would probably be much more significant factors in mode choice decisions than increased Artery capacity.

In sum, there is not enough information to estimate quantitatively the expected induced and converted traffic due to increased Central Artery capacity. Qualitatively, it is reasonable to assume that whatever induced and converted traffic might occur due to the Artery only would be significantly less than that estimated for the new harbor crossing. This is due to several reasons: (1) capacity constraints on the southern end of the Artery, (2) the increased capacity (3 lanes to 4 or 5) is less than the doubling of tunnel capacity, (3) there are significant constraints to traffic growth adjacent to the Artery, including parking supply and cost and limited arterial and local street capacity.

(3:mh:sb

Attachments

FOOTNOTES

1. See C. Buckley, "Logan Airport Ground Traffic in the Year 2010: Three Scenarios," May 24, 1982, and "Logan Airport Ground Traffic in the Year 1990," June 22, 1982, both CTPS memos.

2. Holder, Ronald, and Stover, Vergil, "An Evaluation of Induced Traffic on New Highway Facilities," Texas Transportation Institute, March 1972, pp. 1-2.

3. Reports that were reviewed:

   Cambridge Systematics, Inc. (E. Ruiter) and JHK and Associates, "The Vehicle-Miles of Travel-Urban Highway Supply Relationship," prepared for National Cooperative Highway Research Program, Transportation Research Board, National Research Council, December, 1979.

   Holder and Stover, referred to above.

   Smith, Michael; Schoener, George, "Testing for Significan Induced Trip Making and Travel in Providence, R.I.," Transportation Research Record 673, 1978.

   Transportation Research Institute, Latent Demand for Urban Transportation, Cambridge Mellon, 1968.

   Winfrey, Robley, "Consumer Surplus Does Not Apply to Highway Transportation Economy," Transportation Research Record 550, 1975.

4. Holder and Stover did develop an "induced traffic factor" that was derived from two indices. One was a separation index that summarized the change in accessibility provided by the new facility. The other was a congestion index that estimated the level of congestion that existed before the new facility was available. The more congestion and the higher the improvement in accessibility, the more induced traffic would occur. See p. 28 of their article.

5. Holder, Stover, p. 22; Cambridge Systematics, p. 2:6.

6. Originally used in Tom Lisco's "Preliminary Estimates of Third Harbor Crossing Traffic," July 27, 1979, Figure 1. 1979, 1980, and 1981 data added for this memo.

7. See Lisco, pp. 4-5. Defined by Coverdale and Colpitts in their 1968 report on the Third Harbor Crossing.

8. Lisco, pp. 5-7.

9. An exception to this occurred in 1979, when tunnel traffic increased substantially. In 1979, annual enplanements at Logan spurted up 12 percent above the 1978 figure. Enplanements in 1980 and 1981 remained slightly below the 1979 level.

1. Lisco, Tom, "Assignment Volumes: Toward an Alternative Treatment of Future Trips," CTPS memo, January 5, 1979, p. 4.

1. Based on Lisco, July 27, 1979, Table A-4.

1. The value for a given year is the average of that year and the previous four years. The 1973 non-Logan value of 1,593, for example is (going to Column 1) 6,327 minus 674 minus 50 plus 3,304 minus 942, divided by 5.

1. This is called a weighted average because more weight is given to the more recent data. In this case, triple weight is given to the most recent year, double weight to the previous one. For example, the 1973 value of 0.78 in Column 4 equals (from Column 3) 3 times 1.37 plus 2 times 0.25 plus 0.08, all divided by 6.

1. C. Buckley, "Logan Airport Ground Traffic in the Year 1990," CTPS memo, June 22, 1982, p. 4.

1. C. Buckley, "Logan Airport Ground Traffic in the Year 2010: Three Scenarios," CTPS memo, May 24, 1982, p. 10.

1. C. Buckley, "Logan Airport Traffic for the Base Year (1977)," CTPS memo, May 19, 1982, p. 1.

1. Blue Line numbers are daily boardings at all North Shore stations except Logan. Acquarium, State, Government Center, and Bowdoin stations are <u>not</u> included.

1. The increase in Blue Line ridership that began in 1975 may have continued beyond 1979 if the basic fare had not tripled within a 13-month period. Basic transit fare went from 25 cents to 50 cents in July 1981, 50 cents to 75 cents in August 1981. In May 1982, the fare was reduced from 75 cents to 60 cents.

1. There is some concern that the permanent counter was providing inflated data. It is possible that the average for 1980 and 1981 is closer to the 1.1 percent average of the previous seven years.

CTPS

central transportation planning staff
27 school street boston massachusetts 02108 (617) 451-57[illegible]

MEMORANDUM

TO: Third Harbor Crossing File September 23, 1983

FROM: Yong B. Chang
Tom Lisco

RE: Impact of the Central Artery/Third Harbor Crossing Improvement on Public Transit Ridership

Purpose

The proposed highway improvements, as specified by the preferred alternative (5A modified), are expected to provide better service to highway users. The improvements, which translate to faster travel times through several key existing bottlenecks in the highway system, are expected to encourage some current public transit users to divert to the automobile mode. The purpose of this analysis is to estimate expected changes in public transit ridership as a result of the highway improvements. Additionally, this analysis investigates the effect of a proposed contra-flow lane along the Southeast Expressway between Route 128 and South Station on express bus ridership.

Procedures

An elasticity analysis method was used for the estimation of changes in public transit ridership. Specifically, the decrease in rapid transit and commuter rail ridership due to travel time savings on highways was estimated using cross-elasticity analysis. Also, changes in express bus ridership as affected by auto travel time savings and by a proposed contra-flow bus lane along the Southeast Expressway between Route 128 and South Station were estimated using both cross- and direct-elasticity analysis.

Travelers destined to and through downtown Boston during AM and PM peak periods were assumed to have the option of existing transit travel times or improved highway travel times estimated for Alternative 5A modified. The impact of the proposed contra-flow bus lane on the Southeast Expressway was analyzed separately.

Step-by-step procedures adopted in this analysis are described below:

1. Compute direct and cross-elasticity values based on logit mode choice models calibrated in recent years. See Appendix 1.

2. Assemble and tabulate passenger boardings by station for trips to and through downtown Boston during 7:00 to 10:00 AM.

   - Rapid Transit: 1978 MBTA Systemwide Survey

   - Commuter Rail: 1976 Commuter Rail Survey

   - Bus: Various project studies, peak load point counts, etc.

3. For each station or group of stations, determine if the passengers' highway option will improve, thereby making them a prime candidate for a modal shift away from transit.

4. If yes, compute in-vehicle travel time by auto (on the no-build condition), travel time savings (on the build condition, relative to the no-build), and the travel time savings as a percentage to the overall travel time. See Appendix 1 for detail.

5. Then, compute decrease in transit trips by applying cross-elasticity of demand for transit modes for each station or group of stations.

6. For bus pasengers, in additio to estimated ridership decrease resulting from impr ed highway travel times (Step 5) compute the estimat increase in ridership due to shorter in-vehicle trave times by bus (buses as well as autos will reap the bene t of faster highway travel times) by applying direct-e sticity of demand for bus.

7. Summarize the results by li , by mode, by corridor, and total.

esults

The results of the analysis are shown by corridor in Table 1. s can be seen, in the northeast and northern corridors, fairly ubstantial numbers of trips can be expected to be lost from the apid transit and commuter railroad services. This is because of educed inbound auto travel times on I-93, the Mystic-Tobin ridge, and the Sumner Tunnel. These projected losses are 663 assengers or 3.43 percent of ridership on the Blue Line, 1,306 assengers or 4.84 percent of ridership on the Orange Line, and 62 passengers or 5.55 percent of commuter railroad ridership on orthern routes.

Express bus ridership from the northeast corridor is xpected to be unaffected because buses from this corridor utiize the Mystic-Tobin Brige for which buses will enjoy the same

Table 1
Public Transit Trips Before and After Highway Improvements
1983 Trips

Corridor	Travel Mode	Trips Before	Trips After	Trips Diverted	Percent Change
NE	All Modes	24063	23205	-858	-3.57
	Rapid Transit	19346	18683	-663	-3.43
	Commuter Rail	3912	3717	-195	-4.98
	Bus	805	805	0	0.00
N	All Modes	38915	37270	-1645	-4.23
	Rapid Transit	26990	25684	-1306	-4.84
	Commuter Rail	4406	4139	-267	-6.06
	Bus	7519	7447	-72	-0.96
W	All Modes	65256	65256	0	0.00
	Rapid Transit	56823	56823	0	0.00
	Commuter Rail	4103	4103	0	0.00
	Bus	4330	4330	0	0.00
SW	All Modes	39454	39502	48	0.12
	Rapid Transit	29477	29477	0	0.00
	Commuter Rail	9057	9057	0	0.00
	Bus (1)	920	968	48	5.22
SE	All Modes	49127	48480	-647	-1.32
	Rapid Transit	44174	43226	-948	-2.15
	Commuter Rail	0	0	0	0.00
	Bus (2)	4953	5254	301	6.08
TOTAL		216815	213713	-3102	-1.43

(1) Does not assume contraflow lane.
With contraflow lane the increase is 90 passengers or 9.78% of the total.

(2) Does not assume contraflow lane.
With contraflow lane the increase is 561 passengers or 11.33% of the total.

ecreases in travel times as automobiles. Some bus ridership, owever, can be expected to be lost from the northern corridor ecause of the necessary elimination of the I-93 carpool lane in he 5A modified plan. Because of this, the buses will lose their resent time advantage of about three minutes over automobiles. he expected impact of this will be a projected loss of 72 assengers, or .96 percent of the total.

In the west corridor, no transit trips are expected to be ost to the automobile. This is because the Central Artery/Third arbor Tunnel project is expected to have minimal impacts on tra-el times to and from the western corridor.

In the southwest corridor, the same is expected to be true or rapid transit and commuter rail services. For the areas erved by rapid transit and commuter rail to the southwest, the ighway travel times are expected to remain substantially unaf-ected by the project. For three express bus services, however, here is expected to be an impact. These are services to toughton, Easton, and Providence, which use the Southeast xpressway. For these services, travel times relative to automo-ile will improve in Alternative 5A modified because of the xclusive bus lanes from the Massachusetts Avenue interchange to outh Station. They will improve even more if the contra-flow us lane is operated on the Southeast Expressway from Braintree o the Massachusetts Avenue interchange. The projected impact on he three express bus services to the southwest is a net increase f 48 passengers without the contra-flow lane, and 90 passengers ith the contra-flow lane.

In the Southeast Corridor, rapid transit ridership is xpected to decrease because of improved highway travel tim , hile express bus ridership will increase because of increas ccess to South Station and because of the contra-flow bus l e. he actual projections are a decrease of Red Line ridership 48 or 2.15 percent of the total. For express buses, the ncrease is expected to be 301 passengers or 6.1 percent wit out he contra-flow lane, and 561 passengers or 11.3 percent of the otal with it.

In sum, the Central Artery/Third Harbor Crossing project can e expected to divert approximately 3,100 trips from the transit ystem. Since most of these trips will be to downtown, this ranslates into approximately 2,200 additional automobile trips assuming an average auto occupancy of 1.4). Whether the total hange takes place will depend to a considerable degree on whether he 2,200 extra parking places are provided in downtown Boston. f they are not, the impact of the project will probably be seen ore in increased downtown parking charges rather than in ecreased transit ridership.

YC:TL:sb

The elasticity of demand for the multinomial logit mode choice models is given by the following equations:

$$DE\ (transit,\ IVT_{transit}) = C * VIT_{transit} * (I - MS_{transit})$$

$$CE\ (transit,\ IVT_{auto}) = -C * IVT_{auto} * MS_{auto}$$

Where:

DE: direct-elasticity of demand for transit mode with respect to transit in-vehicle time

CE: cross-elasticity of demand for transit mode with respect to in-vehicle time of auto mode

IVT: in-vehicle travel time (in minute)

C: coefficient of IVT variable in a linear utility function of logit model

MS: market share of a mode (%/100)

Review of logit mode choice models calibrated in recent years shows that values of C have a wide range (-0.005 - -0.050) but are concentrated between -0.02 and -0.03. In this analysis, an average value of -0.025 has been selected.

The market share of alternative modes used in this study is based on the 1982 Boston Proper cordon line crossing study by th BRA. The market shares for the trips to and through downtown Boston during AM peak period (7:00 - 10:00 AM) are:

- Automobile: 56 percent
- Rapid Transit: 31 percent
- Bus: 9 percent
- Commuter Rail: 5 percent

The direct- and cross-elasticity equations, then, are simplified as follows:

$$\begin{aligned} DE\ (Bus,\ IVT_{bus}) &= 0.025 * (1 - 0.09) * IVT_{bus} \\ &= -0.023 * IVT_{bus} \end{aligned}$$

$$\begin{aligned} CE\ (Transit,\ IVT_{auto}) &= 0.025 * 0.56 * IVT_{auto} \\ &= + 0.014 * IVT_{auto} \end{aligned}$$

Graphic representations of these equations are shown in Figure 1. For example, a one percent increase in bus in-vehicle time from 30 minutes to 30.3 minutes will result in 0.69 percent decrease in bus ridership. In a similar manner, a one percent increase in auto in-vehicle time from 30 minutes to 30.3 minutes will result in 0.42 percent increase in all transit modes.

The data required for the computation of changes in transit ridership are:

- Transit passengers by station or group of stations. Specifically, passenger boardings during 7:00 - 10:00 AM destined to and through downtown Boston.

- In-vehicle travel time by auto (on the no-build condition) and travel time savings (on the build condition, relative to the no-build).

- In the case of express buses, in-vehicle travel time on bus (on the no-build condition) and travel time savings on bus in addition to the above item.

The travel time savings by auto as a percentage to the total in-vehicle travel time were computed by the following formula:

$$\frac{(Q^{AM}_{NB} - Q^{AM}_{B} + Q^{PM}_{NB} - Q^{PM}_{B})/2}{T + (Q^{AM}_{NB} + Q^{PM}_{NB})/2} * 100$$

Where:

Q: Delay in minutes during AM peak period (AM) and PM peak period (PM) for no-build (NB) and build (B), respectively. Delay data were based on Lisco's queuing analysis.

T: Highway travel time from a zone representing origins of passengers of a station to a Boston CBD zone during peak period. The data were based on the CTPS regional highway network.

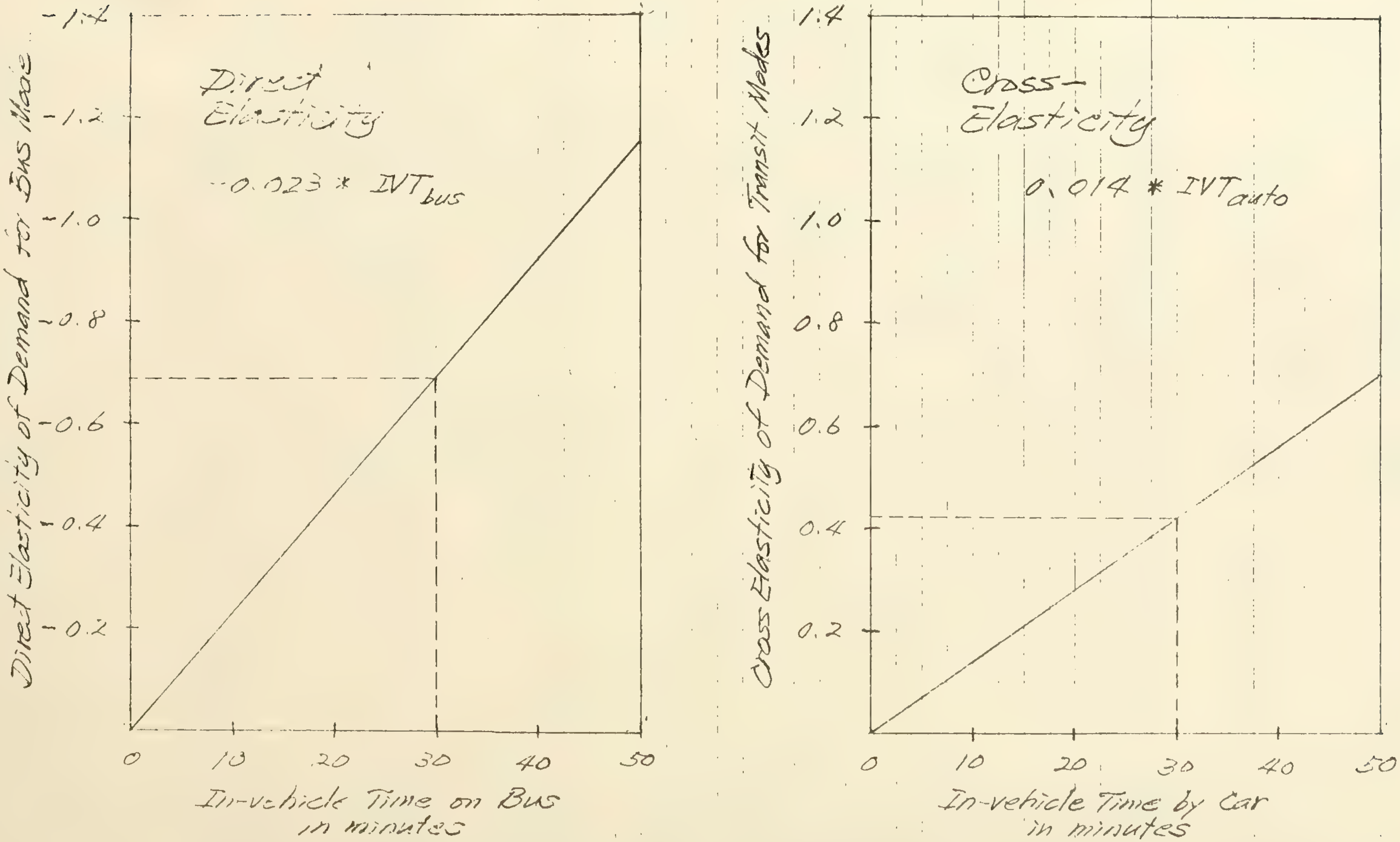


Figure 1

Direct and Cross-Elasticity

MEMO TO: Norm Faramelli, Massport

FROM: Barry Faulkner and Bill Jessiman

DATE: May 28, 1982

RE: Access Mode Impacts of Transit Service Improvements

This memorandum presents the results of an analysis undertaken by Cambridge Systematics of the expected impacts on airport access of several committed and proposed changes in the Boston area rapid transit system plus some sensitivity analysis on the effects of tunnel traffic congestion and transit transfer time sensitivity. The analysis used the same ground access forecasting model (developed by CS for Massport) that was previously used to test the impact of various parking policies.

1.0 Background

1.1 Development of the Model

The ground access forecasting model developed by Cambridge Systematics is described more completely in a memorandum to Massport officials dated August 26, 1981. The basic purpose of the model is to predict the ground access mode choice for air travellers and persons accompanying these travellers to the airport, based upon the attributes of the mode choices available.[1] Based on a spring, 1979, comprehensive survey of air travellers and companions, the model reuses each of the survey observations and simulates

[1] A separate model was developed to deal with access mode choices of Logan airport employees, but the inclusion of an employee analysis as part of this exercise was not possible within the scope of this effort.

each individual's access choice based on the specific attributes of each's situation. Hence, changes in the probablities of choosing each access mode can be predicted for each representative individual observation and in the aggregate in response to a change in the access system. Separate models are used depending upon the traveller's trip purpose (business or non-business), and by whether Logan represents the home or destination end of their airline trip. The following ground access modes are forecasted:

- Transit
- Non-MBTA express bus/limo
- Taxi
- Rental car
  - off-airport rental company
  - on-airport, non-Big 3
  - Hertz, Avis or National
- Auto accompanied by non-travelling companions
  - stop at curb
  - park at meter
  - park in garage
- Auto unaccompanied
  - airport garage
  - park/fly lot

The attributes of each mode which are included in the model are various components of travel time, out-of-pocket costs, availability, and number of transfers. In all, over 40 explanatory variables are included.

The spring 1979, comprehensive survey of air travelers and companions was undertaken to provide base data on the demographic attributes of travellers, mode choice decisions, and air travel characteristics. This data was used to estimate coefficients for the mode choice models and to validate the predictive accuracy of the models against the base case. The models were then used

to forecast the impacts of a series of parking policies based on April, 1981 characteristics of the alternative travel modes (travel times, fares, etc.). The results of these forecasts were presented in the August, 1981 memo. The current analysis also uses the April, 1981 base level of service data, but makes, sequentially, selected changes in the MBTA system to predict the changes in access mode split in response to each improvement.

1.2 Transit Alternatives Tested

Four transit improvements were tested in this analysis:

1) Red Line Extension to Alewife Brook Parkway. This extension is currently under construction, with completion anticipated in 1983 or 1984. This extension includes new stations at Porter Square, Cambridge; Davis Square, Somerville; and Alewife Brook Parkway, Cambridge. The major service impacts include elimination of a bus or other access trip for persons within walking distance, reduced access times for others, and improved bus frequency in the more distant suburbs such as Lexington and Bedford.

2) A Blue Line Extension from Bowdoin to Charles Circle to connect with the Red Line. This project is included in the official transit program for the Boston region, although implementation may be some time off. This extension eliminates a transfer for Red Line riders bound for the airport, along with some system operating improvements.

3) Blue Line Spur to the Airport. This project, not yet included in the region's transit program, would bring a spur off the Blue Line to a new station near the central parking garage at Logan, where passengers would take a moving sidewalk to their terminals. This spur would eliminate a transfer, would result in a significant time savings over the shuttle bus, and would save passengers the 25 cent shuttle bus fare. The extension of the other end of the Blue Line to Charles is still included as well.

4) Blue Line Extension Downtown from Bowdoin to Park Street Plus Blue Line Spur to Airport. This is presented as an alternative to the Charles Street extension in the Program for Mass Transportation. While its service effect is similar for Red Line users, it provides service improvements for more people (Park Street walk-ins and Arborway Line users). The improvements encompassed by alternatives 1 and 3 are assumed here as well.

1.3 Effect of Increased Traffic Congestion Delay in Tunnels

In addition to improvements to the MBTA system, it is likely that furthe increases in traffic congestion in the tunnels, or, more generally, in the area of the airport, would lead to some shift to rapid transit for accessing Logan. To estimate this impact, a separate run (Case 5) was made with the addition of a ten-minute "delay" imposed on all highway access modes. It was applied to all users at all times of the day, although, had resources permitted, it would have been more realistic to limit the ten-minute delay to those users whose highway access alternatives would have logically used the tunnels and to those times of day where traffic congestion was likely.

1.4 Effect of Increased Transit Transfer Time Sensitivity

In the course of estimating the basic access mode choice models, it was not statistically possible to distinguish transit transfer time from normal transit travel time, i.e., attempts to include a separate "transfer" variabl in the models were not able to produce an appropriate magnitude, statistical significant coefficient for that variable. One possible conclusion from thi result is that Logan passengers indeed do not find transfer time any more or less onerous than any other component of travel time. However, this would seem to be inconsistent with the conventional wisdom which would have transfers be a greater deterrent to transit travellers. Accordingly, another pai of runs was made to try to estimate the impact of an increased sensitivity t transit transfers. Specifically, the base case was rerun with an additional five-minute "penalty" time added for every transfer. Then Case 4 (Blue Line to Park plus spur to Logan) was rerun on the same basis to determine the impact of removing transfers under the theoretical case where the passengers' sensitivity to transfer was increased.

.5 Combination of All the Foregoing

Although no separate model runs were made to combine the effects of tran-it system improvements, increased traffic congestion in the tunnels, and an ncreased passenger sensitivity to transfers, their combined effects were ap-roximated using previous results and some simplifying assumptions.

.0 Procedures

2.1 Level of Service Specification

In analyzing the transit system improvement alternatives, changes in ravel time, fares, and number of transfers were estimated for each transit mprovement, compared to the base case (April, 1981 transit system). Values ncluded in the computerized transit network were used where appropriate; new ransit links were estimated using a standard acceleration- deceleration odel. Changes were estimated for travellers from each affected traffic zone r group of zones affected and for AM peak, base period, and PM peak. These hanges were described in detail in a previous technical memorandum, were eviewed by Massport and MBTA staff, and were revised to reflect comments eceived (revised memo is attached).

Computer programs (subroutines) were then written to amend base file data o reflect the new travel times and fares for affected travellers and compan-ons. These subroutines took individual records from the base air passenger urvey file, tested to determine if the trip origin or destination was in the rea affected by the transit improvement in question, then altered whichever alues were changed by the transit improvements (other information on the riginal survey file being preserved as it was). The amended records where hen used in the forecasting step. This procedure was followed for each

transit improvement. The program also produced a count of airport users whose travel time was affected by the improvement.

2.2 Forecasting Runs

The airport access forecasting model developed previously was used to estimate the mode choice for air passengers and companions. A parallel analysis of employee mode choice was technically possible, but beyond the scope of this effort.

The forecasting model was run first on the base case to test the operation of the program after making several minor changes to improve its operation for this anlysis. Six separate sets of analysis runs were made to estimate the impact of each of the four transit improvement options plus a hypothetical case of auto congestion in the Sumner/Callahan Tunnels plus a hypothetical case analysis of increased transfer time sensitivity. The input assumptions to each of these forecasting runs were:

Case 1: The first run assumed that only the Alewife extension was in place.

Case 2: In this run, both the Alewife extension and the Blue Line extension to Charles Street were included.

Case 2a: This run assumed the same combination of improvements as Case 2. However, the travel time changes were adjusted to reflect the closing of Bowdoin Station on the Blue Line, and the reduction of transfer time at Charles Street from 1-1/2 to 1 minute.

Case 3: This run included the Alewife extension, the Blue Line extension to Charles Street, and the Blue Line spur to the center of the airport.

Case 4: This run substituted the Blue Line extension to Park Street for the Blue Line extension to Charles, and also included the Alewife extension and the Blue Line spur to the airport.

Case 5: This run added 10 minutes of travel time to the auto, rental car, taxi, and limo modes. The transit service characteristics

used were the same as for Case 1 (Red Line Alewife extension only).

The forecasting models provided a print-out of mode choice results by arket segment, as well as impacts on parking lot use, VMT, consumer surplus, tc. These are included as an appendix to this memorandum.

In addition to these forecasting runs, three additional cases were analyzed using different methods. These cases were:

Case 6: This case assumed an additional 10-minutes of highway time, similar to Case 5, but also included the full set of transit alternatives, as in Case 4. The transit mode share impacts of this case were extrapolated from the results of Case 4 and 5, and therefore must be considered as approximations of what the model would forecast for this alternative.

Case 7: This case looked at the modal choice impacts of the full set of transit alternatives, assuming a greater sensitivity of travel choice to the number of transit transfers which must be made; that is, if each traveller considered a transfer to be equivalent to an extra five minutes of travel time. The methodology for estimating this impact is described in greater detail below.

Case 8: This case assumed the full set of transit alternatives (as in Case 4), plus a 10-minute highway time penalty for non-transit modes, plus the increased 5-minute sensitivity to transit transfers.

Detailed results of this analysis are presented in Section 3, below. able 1 presents a summary of the impact of each analysis case on transit se by air passengers to Logan.

Note that increased automobile congestion, as reflected by an additional en minutes of travel time for anyone accessing Logan via auto, taxi, rental ar, bus or limo (Case 5), has the same effect on transit ridership as the omplete transit improvement system in Cases 3 or 4. This is an increase from .57 percent to 8.79 percent mode split to the MBTA, an increase in MBTA ransit riding of about a third, but a change which has relatively negligible

Table 1

Alternative	MBTA Passengers	Total Air Passengers	% to MBTA	% Increase Over Base Case
Base Case	2,214	33,689	6.57%	-
1. Red Line Extension to Alewife	2,235	33,689	6.63	1. %
2. Above plus Blue Line to Charles	2,282	33,689	6.77	3.
2a. Above with Bowdoin Closed	2,320	33,689	6.89	5.
3. Case 2 above plus Blue Line Airport	2,896	33,689	8.60	31.
4. In Case 3, substitute Park for Charles	2,909	33,689	8.63	31.
5. Case 1 plus 10 min. auto delay	2,962	33,689	8.79	33.
6. Case 4 plus 10 min. auto delay	3,841	33,689	11.40	74.
7. Case 4 w/ 5 min. transfer sensitivity	3,453	33,689	10.25	56.
8. Case 4 w/ auto time & trnsfr senstvty	4,583	33,689	13.60	107.

impact on ground traffic in the vicinity of the airport. For comparison, the impact on MBTA transit riding in the previous (August 26, 1981) set of alternatives analyzed showed that a 50 percent parking price increase led to an MBTA mode split of 7.00 percent only (2,359 MBTA passengers). Thus, one might conclude that air travellers are more sensitive to time than cost in their access choices, and that deteriorating highway service levels can be as influential as transit system improvements in inducing travellers to shift to the MBTA to access Logan.

In that previous analysis, several other output measures were tabulated for each alternative--vehicle trips, VMT, vehicles parking at Logan, consumer surplus, and Massport revenues. However, none of them change appreciably in these alternatives (except Massport bus revenues of approximately $631 per day being lost when the airport spur is added).

2.3 Quality Control and Analysis

The results of each run were carefully examined to assure accuracy and completeness. Randomly selected input file records were examined to determine that level-of-service changes were accurately entered, and the overall mode choice results were compared to expected results using a simple elasticity calculation. Results were checked against the control total to assure that all airport users were accounted for.

3.0 Results

The results reported here look only at air passengers travelling to or from Logan. Each of the transit improvements and other changes would also affect the trips of persons accompanying air passengers. Inclusion of these trips, however, would be confusing, since the total number of companion trips

varies with each alternative. When transit use by air passengers increases, the number of companion trips decreases (since, logically, transit users have fewer companions on their trips than those who come by auto), even though the share of companion trips by transit increases.

3.1 Alewife Extension

The extension of the Red Line to Alewife results in a small increase in transit trips to and from the airport: only (approximately) 21 trips per day or less than 1 percent above the base case. This results in small decreases in use of each of the other modes, but these changes are insignificantly smal

These changes are small, as a percentage of total airport trips, primarily because the Alewife extension services an area which produces only a small portion of the total air passenger trips. Only 1,001, or 3.0 percent, of the average daily 33,689 air passenger trips to and from the airport have their other trip end in the Red Line extension service area. For this impacted group, MBTA ridership goes from 63 to 84 trips, an increase of 33 percent, reflecting the moderately large change in transit time and cost to the airport. Thus, while the increase in MBTA riding for those affected was significant, relatively few Logan-bound travellers were affected.

Of course, the Red Line extension was designed to serve a different grou of travellers, specifically, downtown-oriented commuters.

3.2 Blue Line Extension to Charles (with Alewife Extension)

The addition of a Blue Line link between Bowdoin and Charles Stations results in an increase of 68 MBTA trips per day to and from the airport, abou 3 percent above the base case. Of these new trips, 21 were accounted for by the Alewife extension alone.

This additional transit improvement reduces travel time for airport-bound iders from the Red Line service area only (both Ashmont/South Shore and Aleife). These riders represent less than 17 percent of all air passengers. Of he directly affected trips, transit ridership goes up by 8 percent over the lewife-only case (11 percent over the base case). This modest increase relects the fact that the travel time improvements for this line, as identified or this analysis, are fairly small, averaging only 2 minutes. This travel ime difference, however, may have been underestimated for two reasons:

- Transit times in the networks are available for weekdays only (peak transit ridership periods), while a sizeable portion of air travel occurs on weekends. The wait times for transit vehicles included in this analysis are somewhat lower than what would be expected for the average annual air travel day.
- The wait time for the Green Line reflects the scheduled frequency of service on that line. However, this schedule is rarely kept in practice. Many trips are dropped because of equipment failure or other reasons, and the operating conditions on the Green Line routes result in extreme "bunching" of vehicles on the line--both factors resulting in an effective increase in the average Green Line wait time. As a result, transit ridership from areas using the Green Line may be slightly overestimated.

This case was also run with two changes in the travel time assumptions, in order to test the sensitivity of the results to these factors. First, it was assumed that Bowdoin Street would remain closed and that the time required to stop and load passengers would be avoided by passengers transferring to the Blue Line at Charles. Second, the transfer time at Charles Street Station was reduced from 1-1/2 to 1 minute to reflect the possibility that this connection could be made direct via escalators. These changes would attract an estimated 38 additional air traveller MBTA trips per day to the airport.

3.3 Blue Line Spur to the Airport (with Alewife and Charles Street Extensions

This run, which included the Blue Line spur into the airport, had a

direct effect on the travel time and cost of all airport-bound transit trips. Consequently, the impact on transit ridership is considerably more pronounced than in previous cases. The airport spur results in an increase of 682 daily air traveller MBTA trips compared with the base case (of which 68 trips were explained by the Alewife and Charles Street improvements). This increase reflects a reduction of 5 to 15 minutes in transit travel time, elimination of a transfer, and a reduction in total fare of 25 cents.

For air passengers, this represents an increase of 31 percent in transit use, from 6.57 percent of all air passenger trips to 8.60 percent. Vehicle trips to and from the airport are reduced by 674 per day (2.4 percent). This saves 9,200 vehicles miles of travel (0.9 percent). The relatively small reduction in VMT is due to the fact that transit draws chiefly from the areas closest to Boston, thus the average length of a trip diverted to transit is smaller than the average of all trips to the airport.

The number of automobiles parked at Logan is reduced by 129 per day, or 1.6 percent, with a loss of parking revenues of $630 per day (which should be added to the $631 per day in shuttle bus revenue lost).

At the request of Massport, the impact of altering the airport spur to include two stations on the airport property was also examined. Replacing the single-station spur with one with stations at the Eastern terminal and the North terminal (with moving sidewalks to the other terminals) would have no appreciable effect on overall transit ridership. Travel time to the Eastern terminal would be reduced by 1.9 minutes, but travel times to the South, North and Volpe terminals would increase by .2, .1, and 3.5 minutes, respectively.

3.4 Blue Line Extension to Park (with Alewife and Airport Spur)

This run replaced the Bowdoin-Charles connection in Case 3 with an exten-
ion of the Blue Line to Park Street. The results of this run were virtually
dentical with those of Case 3. Transferring at Park (instead of Charles) is
ot as convenient for Red Line riders from Cambridge and beyond, but is an im-
rovement for those from the South Shore and Dorchester, and, for Arborway
ine users, a transfer is avoided in this analysis. The net result is a
ight overall increase (13 trips per day) in transit use to the airport com-
red to Case 3, not a significant difference.

3.5 Highway Penalty (with Alewife extension)(Cases 5 and 6)

To simulate the effect of increasing traffic congestion at or near the
irport, this run added a ten-minute travel time penalty to all non-MBTA
odes, using transit service levels as specified for the Alewife-only case
ase 1). This ten-minute penalty was applied to all origin zones and for all
mes of day, in order to test the sensitivity of the model to this factor.
was felt to be a reasonable estimate of the potential delay which could be
used by increased airport traffic. This forecasting run resulted in an in-
rease of 748 transit trips per day by air passengers, a 33 percent increase
ver the Alewife-only case. If this ten-minute delay occurred in addition to
e transit service improvements as presented in Case 4, the estimated modal
are for transit to the airport would rise to approximately 11.4 percent,
4 percent higher than current levels.[1]

[1]By simply mathematically combining the two effects--a simplification,
ut one which, for the region of changes involved, is acceptable--i.e.,
1.31)(1.33) = 1.74; (1.74)(6.57) = 11.40% mode split to MBTA.

3.6 Transfer Sensitivity and Notes on Sensitivity to Transfers (Cases 7, 8)

In estimating the coefficients of the Massport ground access mode models an attempt was made to account separately for in-vehicle transit travel time (bus, rapid transit, and commuter rail line-haul time) and out-of-vehicle time (wait, walk, and transfers). However, satisfactory results were obtained only for the non-local business travellers. For this model, a minute of out-of-vehicle time had the same effect as 2.3 minutes of in-vehicle time. For each of the others, the initial calibration resulted in coefficients which implied that out-of-vehicle time had less effect than the same amount of in-vehicle time. Since this result is counterintuitive, in subsequent calibration runs only total travel time (a simple addition of in-vehicle and out-of-vehicle time) was used. In each of the models, transfers were given a value of one minute of out-of-vehicle time, a penalty applied in addition to the actual time required for walking and waiting at transfer stations. Even so, the business local and both non-business models are fairly insensitive to the number of transfers required; that is, adding or eliminating transfers has only a small impact on transit mode choice.

There are a number of possible explanations for these results: out-of-vehicle time and number of transfers may be highly correlated with some other variable, such as in-vehicle time (long transit trips may generally have more transfers and out-of-vehicle time than short transit trips), or the effect of transfers may not vary enough to distinguish this variable from the transit constant term. Statistically, we cannot reject the possibility that, in fact air travellers are not particularly sensitive to the number of transfers they must make. However, many other studies have indicated that transfers, and

ut-of-vehicle time, are more important determining factors than in-vehicle ime in the modal choice decision, and logically we would support that posi- ion.

It is possible to simulate a greater sensitivity to transfers or out-of- ehicle time in the model. The most satisfactory way to do this would be to ncrease the transfer penalty or weighting of out-of-vehicle time, and then to ecalibrate the model. This effort was well beyond the scope of the current tudy. A second, more approximate, estimate of transfer sensitivity was made sing the following procedure: using current model coefficients, an addition- l five-minute penalty (for a total of six minutes) for all transfers was ap- lied to both the base case and Case 4. For this exercise, the transit use in Case 4 was 56 percent higher than in the base case, implying this type of sen- sitivity to the removal of a (now more costly) transfer. Applying this kind of ridership increase to the existing base case results procedures an esti- mated mode split to the MBTA of (1.56) (6.57 percent) = 10.25 percent or an increase in air traveller MBTA passengers of 1,239 from 2,214 to an estimated 3,453 per day. (In our previous analysis of Case 4, only an 8.63 percent mode split was predicted; hence the effect of more severe assumptions about the weight air travellers might assign to transfers.) This result was included as Case 7 in the above summary.

If the increased transfer sensitivity and full set of transit improve- ments are added to the highway penalty assumption as in Case 5, the total es- timated transit use would be approximately 13.60 per cent,[1] or 4583 transit trips by air passengers.

[1](1.56)(1.33) = 2.07; (2.07)(6.57) = 13.6% mode split to MBTA.

4.0 Conclusions

The transit improvements examined in this analysis have a seemingly appreciable impact on transit use for airport access--an increase of over 33 percent compared to present transit use. However, because transit use is fairly small at the present time, this increase represents only about 2.2 percent of all air travellers (an increase in the transit share from the present 6.57 percent to about 8.63 percent). Most of this increase in transit use would result from the extension of the Blue Line on airport property, since this project would have a significant travel time impact on more airport travellers--not just a portion of them served by a change in one particular corridor.

These transit improvements also result in considerable time and cost savings for existing transit users, and have systemwide benefits in improved transit operations, reduced crowding, and ridership improvements for downtown-oriented trips. The full range of impacts of these transit improvements is beyond the scope of this study.

It should also be clear from this analysis that any event which would increase travel time to the airport by highway modes would also have a substantial impact on transit use--ten minutes of additional highway time would have as much impact as the full set of transit alternatives under existing highway conditions.

Appendices

Run Outputs

S SUMMARIES Base Case

PX PERSON-TRIPS

NMODE

EG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
LIC	602	819	1795	308	2944	5340	11808
NN	498	786	2644	2747	993	0	7667
LIC	557	896	764	47	5402	1307	8973
NN	557	504	1446	949	1785	0	5240
A	2214	3005	6648	4051	11124	6647	33689

AL CAR

EG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
SDC	12	40	255	308
SDN	106	356	2285	2746
ADC	2	6	40	47
ADN	56	148	745	949
L	177	549	3325	4051

PARK

EG	PARK_TYPE CURB	METER	GARAGE	TOTAL
SOC	1962	296	686	2944
SON	584	115	295	993
AOC	2811	655	1936	5402
AON	780	323	681	1784
L	6137	1389	3598	11124

PARK

EG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
OC	5033	308	5341
ON	0	0	0
OC	1194	113	1307
ON	0	0	0
L	6227	421	6647

VEHICLE TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	0	1415	231	4581	4080
BUSNON	0	0	1995	2184	1671	0
PLALOC	0	0	489	35	6598	763
PLANON	0	0	918	677	2608	0
TOTAL	0	0	4817	3127	15459	4843

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1042)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	30	192	231
BUSNON	84	283	1817	2184
PLALOC	2	4	29	35
PLANON	39	103	534	677
TOTAL	134	420	2573	3127

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	3064	464	1053	4582
BUSNON	988	191	492	1671
PLALOC	3357	819	2423	6599
PLANON	1161	473	974	2608
TOTAL	8571	1946	4942	15459

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	3889	191	4080
BUSNON	0	0	0
PLALOC	711	52	763
PLANON	0	0	0
TOTAL	4600	243	4843

IANION PERSON-TRIPS

MODE

SEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
SLOC	0	18	132	0	6789	0	6940
SION	26	49	71	206	2068	0	2420
ALOC	26	168	60	21	10512	0	10787
AION	257	38	130	129	4347	0	4901
TL	309	273	393	356	23716	0	25047

NAL CAR

SEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
SOC	0	0	0	0
SON	8	27	171	206
AOC	1	2	18	21
AON	8	20	101	129
TL	17	49	290	356

APARK

SEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
SLOC	4214	545	2029	6789
SION	1100	302	666	2068
ALOC	4369	1597	4546	10512
AION	1630	847	1870	4347
TAL	11313	3291	9112	23716

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-711774	-498124
BUSNON	-67970	-198229
PLALOC	459548	140216
PLANON	-179699	-64030
TOTAL	-499896	-620166

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	OT
BUSLOC	0	0	23792	13546	142702	143319	333
BUSNON	0	0	15696	104650	71183	0	115
PLALOC	0	0	11968	1543	240064	40456	240
PLANON	0	0	15209	41731	107573	0	145
TOTAL	0	0	66665	161469	561523	183775	934

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26580)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	OT
BUSLOC	771	7515	36513	6702	7643	53977	1131
BUSNON	478	5522	24491	61666	3941	0	60
PLALOC	995	8685	18313	743	12737	13996	54
PLANON	733	3422	23077	20280	5713	0	32
TOTAL	2977	25144	102394	89391	30034	67973	379

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	OT
BUSLOC	39998	67936	76158	35187	157923	328359	755
BUSNON	23691	51844	74967	264964	62829	0	432
PLALOC	50745	84165	41262	4562	333345	112707	657
PLANON	38392	30843	54938	112351	117070	0	335
TOTAL	152826	234787	247326	417065	671166	441066	2142

/NUES (DOLLARS)

?EG	MBTA	MPA_BUS	XBUS	TAXI
?IOC	620	151	7683	37860
?ION	372	131	5863	24819
?IOC	896	146	10314	19029
?ION	867	203	3680	24118
T?L	2756	631	27541	105826

?ING REVENUES (DOLLARS)

?EG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
SOC	232	527	27530	1267
SON	95	246	0	0
AOC	410	1211	9263	671
AON	236	487	0	0
TL	973	2471	36793	1938

A PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
L SEGS	276	702	6937	7915

AIRPAX PERSON-TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	T[illegible]
BUSLOC	615	819	1792	308	2941	5335	[illegible]
BUSNON	500	786	2643	2746	993	0	[illegible]
PLALOC	561	896	763	47	5399	1306	[illegible]
PLANON	559	503	1446	949	1783	0	[illegible]
TOTAL	2235	3004	6643	4049	11116	6641	[illegible]

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	12	40	255	308
BUSNON	106	356	2284	2746
PLALOC	2	6	40	47
PLANON	56	147	745	949
TOTAL	177	549	3324	4049

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	1960	296	685	2941
BUSNON	584	115	295	993
PLALOC	2810	655	1935	5399
PLANON	780	323	680	1783
TOTAL	6133	1388	3595	11117

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	5028	307	5335
BUSNON	0	0	0
PLALOC	1193	113	1306
PLANON	0	0	0
TOTAL	6221	420	6641

ODE

E	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
O	0	0	1412	231	4576	4075	10295
O	0	0	1995	2183	1671	0	5848
O	0	0	489	35	6594	763	7880
OI	0	0	917	676	2606	0	4200
L	0	0	4813	3126	15446	4838	28223

CHEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1040)

A. CAR

EG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
LC	9	30	192	231
NN	84	283	1816	2183
LC	2	4	29	35
NN	39	103	534	676
AI	134	420	2572	3126

ARK

EG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LC	3061	464	1052	4576
NN	988	191	492	1671
LC	3355	818	2421	6594
NN	1160	472	974	2606
A	8564	1945	4938	15447

ARK

EG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
IC	3885	190	4075
IN	0	0	0
IC	711	52	763
IN	0	0	0
L	4595	243	4838

COMPANION PERSON-TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	0	18	132	0	6782	0	[illegible]
BUSNON	26	49	71	206	2067	0	[illegible]
PLALOC	26	168	60	21	10506	0	[illegible]
PLANON	259	38	130	129	4344	0	[illegible]
TOTAL	311	273	393	356	23699	0	[illegible]

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	0	0	0	0
BUSNON	8	27	171	206
PLALOC	1	2	18	21
PLANON	8	20	101	129
TOTAL	17	49	290	356

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	4210	545	2027	6782
BUSNON	1099	302	666	2067
PLALOC	4367	1596	4543	10506
PLANON	1629	846	1869	4344
TOTAL	11305	3289	9105	23699

CONSUMER SURPLUS

DOLLARS	MINUTES
-711246	-497782
-67938	-198163
459953	140397
-179314	-63923
-498546	-619471

VMT

MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
0	0	23759	13544	142638	143260	323200
0	0	15692	104643	71177	0	191511
0	0	11965	1542	240019	40452	293978
0	0	15204	41727	107550	0	164481
0	0	66619	161456	561383	183712	973170

-IEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26558)

ATE AIRPAX COST (DOLLARS)

MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
788	7509	36464	6698	7639	53936	113034
480	5521	24485	61654	3941	0	96081
1000	8684	18307	743	12734	13992	55460
736	3421	23069	20273	5712	0	53210
3004	25135	102326	89368	30025	67929	317785

EATE AIRPAX TIME (MINUTES)

MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
40528	67896	76043	35174	157819	328162	705621
23747	51839	74952	264928	62819	0	478286
50834	84156	41246	4561	333255	112692	626743
38450	30826	54917	112328	117032	0	353554
153559	234716	247158	416991	670926	440854	2164196

REVENUES (DOLLARS)

MKTSEG	MBTA	MPA_BUS	XBUS	TAXI
BUSLOC	634	154	7677	37810
BUSNON	374	131	5862	24813
PLALOC	900	147	10313	19023
PLANON	871	204	3678	24110
TOTAL	2779	636	27531	105756

PARKING REVENUES (DOLLARS)

MKTSEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
BUSLOC	232	526	27504	1266
BUSNON	95	246	0	0
PLALOC	409	1210	9260	671
PLANON	236	487	0	0
TOTAL	972	2469	36764	1937

PEAK PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
ALL SEGS	276	701	6930	7907

UMMARIES

Case 2

XPERSON-TRIPS

MDE

	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
C	631	818	1787	307	2937	5329	11808
N	515	784	2637	2741	991	0	7667
C	568	896	762	47	5395	1306	8973
N	569	501	1443	947	1779	0	5240
	2282	2999	6629	4043	11101	6635	33689

L CAR

	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
	12	40	255	307
	105	355	2280	2741
	2	6	40	47
	56	147	743	947
	176	548	3318	4043

RK

	PARK_TYPE CURB	METER	GARAGE	TOTAL
	1957	295	684	2936
	582	114	294	990
	2807	654	1934	5395
	778	322	679	1779
	6125	1386	3591	11101

RK

	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
C	5022	307	5329
N	0	0	0
C	1193	113	1306
N	0	0	0
	6215	420	6635

VEHICLE TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	T[illegible]
BUSLOC	0	0	1408	231	4568	4070	1[illegible]
BUSNON	0	0	1990	2179	1666	0	[illegible]
PLALOC	0	0	487	35	6587	762	[illegible]
PLANON	0	0	915	675	2599	0	[illegible]
TOTAL	0	0	4800	3120	15420	4833	2[illegible]

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1036)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	30	192	231
BUSNON	84	282	1813	2179
PLALOC	2	4	29	35
PLANON	39	103	533	675
TOTAL	134	419	2567	3120

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	3055	463	1050	4568
BUSNON	985	190	491	1666
PLALOC	3352	818	2418	6588
PLANON	1157	471	971	2599
TOTAL	8549	1941	4930	15421

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	3880	190	4070
BUSNON	0	0	0
PLALOC	710	52	762
PLANON	0	0	0
TOTAL	4590	242	4833

ION PERSON-TRIPS

ODE

	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
	0	18	132	0	6772	0	6922
	27	48	71	206	2062	0	2414
	27	168	60	21	10498	0	10773
	262	38	130	129	4334	0	4893
	316	273	392	355	23666	0	25002

A CAR

	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
	0	0	0	0
	8	27	171	206
	1	2	18	21
	8	20	101	129
L	17	49	290	355

ARK

	PARK_TYPE CURB	METER	GARAGE	TOTAL
	4203	544	2025	6772
	1096	301	665	2062
	4363	1595	4540	10498
	1626	844	1864	4334
	11289	3284	9093	23666

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-710590	-497322
BUSNON	-67670	-197517
PLALOC	460624	140701
PLANON	-177498	-63502
TOTAL	-495134	-617639

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TTA
BUSLOC	0	0	23726	13541	142569	143212	3204
BUSNON	0	0	15663	104606	71141	0	1941
PLALOC	0	0	11957	1542	239954	40447	2990
PLANON	0	0	15188	41715	107487	0	1639
TOTAL	0	0	66535	161405	561151	183659	9775

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26525)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TTA
BUSLOC	804	7505	36415	6691	7634	53889	1193
BUSNON	495	5512	24441	61570	3938	0	[illegible]
PLALOC	1006	8682	18296	742	12729	13986	[illegible]
PLANON	746	3413	23047	20247	5707	0	[illegible]
TOTAL	3051	25111	102199	89250	30008	67875	[illegible]

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTA
BUSLOC	40958	67862	75895	35155	157700	327992	7656
BUSNON	24207	51760	74809	264694	62759	0	4323
PLALOC	50889	84140	41213	4559	333149	112673	6562
PLANON	38556	30757	54855	112256	116935	0	3335
TOTAL	154611	234518	246772	416664	670543	440665	21376

US (DOLLARS)

G	MBTA	MPA_BUS	XBUS	TAXI
)C	646	158	7673	37759
)N	385	135	5853	24768
)C	905	149	10310	19011
)N	881	208	3670	24086
	2818	650	27505	105625

N REVENUES (DOLLARS)

E	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
)	231	525	27472	1265
)	95	245	0	0
)	409	1209	9254	671
)	235	485	0	0
L	971	2465	36726	1935

ARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
SGS	276	700	6922	7898

AIRPAX PERSON-TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	644	817	1783	307	2933	5324	11[illegible]
BUSNON	525	782	2634	2737	988	0	7[illegible]
PLALOC	573	896	761	47	5391	1305	8[illegible]
PLANON	577	500	1442	946	1776	0	5[illegible]
TOTAL	2320	2995	6620	4037	11088	6629	33[illegible]

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	12	40	255	307
BUSNON	105	355	2277	2737
PLALOC	2	6	40	47
PLANON	56	147	742	946
TOTAL	176	548	3313	4037

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	1955	295	683	2933
BUSNON	581	114	293	988
PLALOC	2806	654	1932	5392
PLANON	777	322	677	1776
TOTAL	6118	1384	3586	11088

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	5017	307	5324
BUSNON	0	0	0
PLALOC	1192	113	1305
PLANON	0	0	0
TOTAL	6210	420	6629

CE TRIPS

IDE

E	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
O	0	0	1405	230	4562	4066	10263
O	0	0	1987	2175	1662	0	5824
O	0	0	487	35	6581	762	7864
O	0	0	914	674	2593	0	4180
L	0	0	4792	3115	15397	4828	28132

DHEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1033)

A CAR

E	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
C	9	30	192	230
CI	84	282	1810	2175
C	2	4	29	35
CI	39	103	532	674
L	134	418	2563	3115

ARK

G	PARK_TYPE CURB	METER	GARAGE	TOTAL
C	3051	462	1049	4562
IN	983	190	490	1662
C	3349	817	2416	6582
IN	1154	470	969	2593
L	8537	1938	4923	15398

ARK

G	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
C	3876	190	4066
N	0	0	0
C	710	52	762
N	0	0	0
.	4586	242	4828

COMPANION PERSON-TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	0	18	132	0	6763	0	[illegible]
BUSNON	28	48	71	205	2058	0	[illegible]
PLALOC	27	168	60	21	10491	0	[illegible]
PLANON	266	38	130	129	4325	0	[illegible]
TOTAL	321	272	392	355	23637	0	[illegible]

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	0	0	0	0
BUSNON	8	27	171	205
PLALOC	1	2	18	21
PLANON	8	20	101	129
TOTAL	17	49	289	355

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	4198	543	2022	6763
BUSNON	1094	300	663	2058
PLALOC	4360	1594	4536	10491
PLANON	1622	842	1861	4325
TOTAL	11274	3279	9083	23637

XCONSUMER SURPLUS

G	DOLLARS	MINUTES
C	-710061	-496931
N	-67470	-197045
C	461219	140964
N	-175939	-63136
	-492250	-616148

VMT

	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
	0	0	23700	13538	142508	143170	322915
	0	0	15644	104576	71112	0	191332
	0	0	11951	1542	239892	40442	293827
	0	0	15175	41705	107429	0	164309
	0	0	66470	161361	560941	183612	972383

-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26497)

EATE AIRPAX COST (DOLLARS)

E	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
C	818	7500	36376	6685	7630	53848	112857
C	505	5505	24411	61501	3936	0	95858
C	1012	8679	18287	742	12725	13980	55425
C	754	3406	23028	20223	5702	0	53113
L	3089	25090	102102	89152	29993	67827	317253

EATE AIRPAX TIME (MINUTES)

E	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
C	41320	67830	75780	35138	157597	327842	705508
N	24511	51697	74719	264504	62710	0	478142
C	50955	84123	41189	4557	333047	112655	626527
N	38642	30697	54805	112188	116847	0	353180
	155429	234348	246494	416388	670201	440498	2163352

REVENUES (DOLLARS)

MKTSEG	MBTA	MPA_BUS	XBUS	TAXI
BUSLOC	657	161	7668	37718
BUSNON	394	138	5845	24738
PLALOC	910	150	10308	19002
PLANON	890	211	3663	24066
TOTAL	2851	660	27483	105525

PARKING REVENUES (DOLLARS)

MKTSEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
BUSLOC	231	525	27444	1263
BUSNON	95	245	0	0
PLALOC	408	1208	9249	670
PLANON	235	484	0	0
TOTAL	969	2462	36693	1934

PEAK PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
ALL SEGS	275	699	6916	7890

SUMMARIES Case 3

A PERSON-TRIPS

ODE

E	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
C	831	807	1727	303	2883	5258	11808
CI	715	764	2531	2692	965	0	7667
C	667	887	749	47	5331	1292	8973
CI	683	485	1412	928	1732	0	5240
L	2896	2943	6419	3970	10911	6550	33689

% CAR

EG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
LC	12	40	251	303
NN	103	349	2240	2692
LC	2	6	39	47
NN	55	144	728	928
AL	173	539	3258	3970

ARK

EG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LC	1922	290	672	2883
NN	567	111	286	965
LC	2774	646	1911	5331
NN	757	314	661	1732
L	6020	1361	3530	10911

PARK

EG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
OC	4955	303	5258
ON	0	0	0
OC	1180	112	1292
ON	0	0	0
L	6136	415	6551

VEHICLE TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	T[illegible]
BUSLOC	0	0	1358	227	4481	4014	1[illegible]
BUSNON	0	0	1904	2137	1621	0	[illegible]
PLALOC	0	0	478	35	6499	754	[illegible]
PLANON	0	0	889	658	2516	0	[illegible]
TOTAL	0	0	4629	3058	15117	4768	2[illegible]

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1010)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	29	189	227
BUSNON	82	277	1778	2137
PLALOC	2	4	29	35
PLANON	38	100	520	658
TOTAL	131	411	2516	3058

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	2997	453	1031	4481
BUSNON	959	184	478	1620
PLALOC	3306	806	2387	6500
PLANON	1120	456	940	2516
TOTAL	8382	1900	4836	15118

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	3826	188	4014
BUSNON	0	0	0
PLALOC	702	51	754
PLANON	0	0	0
TOTAL	4529	239	4768

PNION PERSON-TRIPS

MODE

EG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
3LOC	0	18	127	0	6649	0	6795
3NON	38	47	68	202	2008	0	2363
ALOC	31	166	59	21	10373	0	10651
ANON	315	37	127	126	4220	0	4824
TL	384	268	381	349	23251	0	24633

NAL CAR

TEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
SLOC	0	0	0	0
SNON	8	26	168	202
ALOC	1	2	17	21
ANON	8	20	99	126
TAL	16	48	284	349

PARK

SEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
SLOC	4127	534	1989	6649
SNON	1069	292	647	2008
ALOC	4311	1576	4487	10373
ANON	1582	822	1815	4220
TAL	11088	3224	8938	23251

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-703184	-491764
BUSNON	-63992	-188805
PLALOC	471601	145221
PLANON	-157388	-58817
TOTAL	-452963	-594165

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTA[illegible]
BUSLOC	0	0	23324	13476	141272	142249	323[illegible]
BUSNON	0	0	15215	104110	70671	0	1[illegible]
PLALOC	0	0	11830	1531	238096	40259	297[illegible]
PLANON	0	0	14902	41383	105966	0	162[illegible]
TOTAL	0	0	65271	160500	556006	182508	962[illegible]

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26160)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTA[illegible]
BUSLOC	869	7417	35805	6616	7554	53255	[illegible]
BUSNON	514	5416	23747	60733	3905	0	[illegible]
PLALOC	1028	8608	18104	733	12622	13854	[illegible]
PLANON	738	3324	22616	19905	5615	0	[illegible]
TOTAL	3149	24764	100272	87988	29696	67109	[illegible]

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTA[illegible]
BUSLOC	48604	67098	74079	34877	155887	325226	[illegible]
BUSNON	28482	50928	72221	262122	62074	0	[illegible]
PLALOC	55522	83487	40719	4518	330337	112060	[illegible]
PLANON	41788	29992	53868	111082	115191	0	[illegible]
TOTAL	174397	231505	240887	412599	663490	437286	[illegible]

EIJES (DOLLARS)

SIG	MBTA	MPA_BUS	XBUS	TAXI
LC	661	208	7583	37126
NN	353	188	5750	24065
LC	902	175	10223	18812
NN	829	249	3575	23636
TA.	2745	820	27131	103639

KING REVENUES (DOLLARS)

TEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
SIDC	227	516	27090	1247
SIDN	92	239	0	0
AIDC	403	1193	9149	664
AIDN	228	470	0	0
TL	950	2418	36239	1911

A PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
L SEGS	270	687	6829	7786

XCAST SUMMARIES

AIRPAX PERSON-TRIPS Case 4

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	833	807	1726	303	2883	5257
BUSNON	723	763	2529	2690	963	0
PLALOC	669	887	749	47	5329	1292
PLANON	684	485	1412	928	1732	0
TOTAL	2909	2941	6416	3967	10907	6549

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	12	40	251	303
BUSNON	103	349	2237	2689
PLALOC	2	6	39	47
PLANON	55	144	728	928
TOTAL	173	538	3256	3967

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	1921	290	672	2882
BUSNON	566	111	286	963
PLALOC	2773	646	1911	5330
PLANON	757	314	661	1731
TOTAL	6018	1360	3529	10907

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	4954	303	5257
BUSNON	0	0	0
PLALOC	1180	112	1292
PLANON	0	0	0
TOTAL	6135	415	6550

NMODE

SG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
LC	0	0	1357	227	4480	4014	10078
NIN	0	0	1902	2135	1618	0	5654
LIC	0	0	478	35	6497	754	7764
NIN	0	0	889	658	2515	0	4061
A.	0	0	4626	3055	15110	4767	27558

A)-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1009)

TAL CAR

TEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
SIDC	9	29	189	227
SIDN	82	277	1776	2135
ADC	2	4	29	35
AON	38	100	519	658
TL	131	410	2513	3055

APARK

TEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
S.OC	2996	453	1031	4480
SION	957	184	477	1618
.OC	3306	806	2387	6498
.NON	1119	456	939	2515
TAL	8378	1899	4834	15111

I PARK

SEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
ULOC	3826	188	4014
UNON	0	0	0
LLOC	702	51	754
.NON	0	0	0
TAL	4528	239	4767

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	18	127	0	6647	0
BUSNON	38	47	68	202	2005	0
PLALOC	32	166	59	21	10371	0
PLANON	315	37	127	126	4218	0
TOTAL	385	268	381	349	23241	0

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	0	0	0	0
BUSNON	8	26	168	202
PLALOC	1	2	17	21
PLANON	8	20	99	126
TOTAL	16	48	284	349

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	4126	533	1988	6647
BUSNON	1067	292	646	2005
PLALOC	4310	1575	4486	10371
PLANON	1581	822	1814	4218
TOTAL	11084	3222	8935	23241

RAX CONSUMER SURPLUS

TEG	DOLLARS	MINUTES
SLOC	-703113	-491693
SION	-63832	-188440
AOC	471793	145297
AION	-157056	-58737
TAL	-452209	-593573

IGHWAY VMT

SEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
ULOC	0	0	23322	13476	141262	142244	320303
UNON	0	0	15200	104087	70649	0	189936
LLOC	0	0	11830	1531	238077	40258	291696
LNON	0	0	14898	41379	105950	0	162228
OAL	0	0	65250	160474	555938	182502	964164

DAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26154)

GREGATE AIRPAX COST (DOLLARS)

SEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BSLOC	871	7416	35801	6616	7553	53248	111505
BSNON	520	5410	23725	60682	3903	0	94241
PALOC	1029	8607	18103	733	12621	13852	54946
PANON	739	3323	22611	19899	5614	0	52185
TAL	3160	24756	100240	87929	29691	67100	312877

GREGATE AIRPAX TIME (MINUTES)

TSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
SLOC	48660	67092	74062	34875	155870	325206	705765
SNON	28829	50880	72156	261981	62037	0	475882
ALOC	55563	83478	40717	4517	330299	112054	626628
ANON	41807	29981	53859	111062	115166	0	351876
TAL	174858	231432	240793	412435	663373	437260	2160145

REVENUES (DOLLARS)

MKTSEG	MBTA	MPA_BUS	XBUS	TAXI
BUSLOC	663	208	7582	37122
BUSNON	357	190	5745	24043
PLALOC	903	175	10222	18811
PLANON	830	250	3573	23631
TOTAL	2753	824	27122	103607

PARKING REVENUES (DOLLARS)

MKTSEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
BUSLOC	227	515	27086	1247
BUSNON	92	238	0	0
PLALOC	403	1193	9148	663
PLANON	228	470	0	0
TOTAL	950	2417	36234	1910

PEAK PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
ALL SEGS	270	686	6828	7784

SUMMARIES

Case 5

PERSON-TRIPS

MODE

SEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
LC	894	815	1733	306	2773	5288	11808
NN	640	787	2598	2758	885	0	7667
LIC	710	897	756	47	5257	1305	8973
NN	718	484	1410	930	1698	0	5240
AL	2962	2984	6497	4042	10613	6593	33689

AL CAR

SEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
SOC	12	40	254	306
SON	106	358	2295	2758
AOC	2	6	39	47
AON	55	145	730	930
AL	176	548	3318	4042

PARK

SEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LOC	1847	279	647	2773
NON	520	102	263	885
LOC	2734	636	1887	5257
NON	742	307	648	1698
AL	5843	1325	3446	10613

-PARK

SEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
SLOC	4983	305	5288
SNON	0	0	0
ALOC	1192	113	1305
ANON	0	0	0
TAL	6175	418	6593

VEHICLE TRIPS

MAIN MODE

MKTSEG	MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	0	1360	229	4313	4036
BUSNON	0	0	1958	2194	1489	0
PLALOC	0	0	483	35	6408	761
PLANON	0	0	885	658	2462	0
TOTAL	0	0	4686	3117	14671	4797

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1024)

RENTAL CAR

MKTSEG	OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	30	191	229
BUSNON	84	284	1826	2194
PLALOC	2	4	29	35
PLANON	38	100	520	658
TOTAL	133	419	2565	3117

A/A PARK

MKTSEG	CURB	METER	GARAGE	TOTAL
BUSLOC	2882	436	995	4313
BUSNON	880	170	439	1489
PLALOC	3257	794	2357	6409
PLANON	1095	446	921	2462
TOTAL	8115	1845	4712	14672

A/U PARK

MKTSEG	ON-A/P	PARK/FLY	TOTAL
BUSLOC	3847	189	4036
BUSNON	0	0	0
PLALOC	709	52	761
PLANON	0	0	0
TOTAL	4557	241	4797

MANION PERSON-TRIPS

I MODE

TEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
SLOC	0	18	128	0	6395	0	6541
SION	34	49	70	207	1842	0	2201
ALOC	34	168	59	21	10231	0	10513
AION	331	37	127	127	4136	0	4757
TAL	398	272	384	354	22605	0	24013

NTAL CAR

KSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
ULOC	0	0	0	0
UNON	8	27	172	207
LLOC	1	2	18	21
LNON	8	20	99	127
OAL	16	49	289	354

/ PARK

KSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
ULOC	3967	514	1915	6395
UNON	979	268	595	1842
LLOC	4249	1552	4431	10231
LNON	1550	805	1781	4136
TAL	10745	3139	8721	22605

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-882552	-611921
BUSNON	-100279	-273493
PLALOC	230617	51524
PLANON	-396164	-111045
TOTAL	-1148377	-944935

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	0	23521	13623	136513	143210
BUSNON	0	0	15614	106380	65551	0
PLALOC	0	0	11973	1549	235166	40601
PLANON	0	0	14934	41610	104273	0
TOTAL	0	0	66041	163162	541503	183811

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26476)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	1167	7500	36107	6679	7296	53676
BUSNON	619	5560	24366	62267	3619	0
PLALOC	1277	8710	18322	741	12466	13990
PLANON	963	3331	22667	19961	5522	0
TOTAL	4026	25101	101461	89647	28903	67666

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	60008	75982	91914	38307	178158	380183
BUSNON	30612	60143	100031	295349	66146	0
PLALOC	64871	93465	48759	5042	378824	126094
PLANON	50161	34918	68055	120923	130332	0
TOTAL	205652	264508	308759	459622	753460	506277

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NES (DOLLARS)

E	MBTA	MPA_BUS	XBUS	TAXI
O	944	224	7668	37440
OI	483	168	5904	24692
O	1152	186	10344	19038
O	1144	262	3582	23689
L	3723	840	27498	104859

IC REVENUES (DOLLARS)

E	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
C	218	497	27318	1258
CI	85	220	0	0
C	397	1179	9243	671
CI	223	460	0	0
L	923	2356	36562	1929

PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
EGS	262	669	6871	7803

MEMO TO: Norm Faramelli, Massport

FROM: Barry Faulkner and Bill Jessiman

DATE: May 28, 1982

RE: Summary of Access Mode Impact Analysis

The attached report shows the effects of various Blue Line extension configurations on the mode split of passengers using Logan airport. The computer model, as developed for the Logan Land Use Planning Studies, was run reflecting four sets of conditions:

A. Transit Configurations

The model was first run (without considering any changes from existing traffic delays and transfer times per transfer) for the following configurations:

1) Red Line extension to Alewife.

2) Red Line extension to Alewife, as above, plus a Blue Line extension to connect with the Red Line at either Charles St. Park St. Stations.

3) Red Line and Blue Line extensions as in 1) and 2) above, plus a Blue Line spur from Airport Station to the Mall near the Central Parking Garage, with passengers using moving sidewalks to go to and from the terminals.

The results indicate that the major mode split benefits are derived from the Blue Line spur to Logan.

	Estimated Mode Split (% of air passengers using T to or from Logan)
Current (Base Case)	6.6%
(1) Alewife extension	6.6+%
(2) Alewife plus Blue Line to Red Line (at Charles St. or Park St. Stations)	6.8-6.9%
(3) Alewife plus Blue Line to Red Line plus Blue Line spur to Logan center mall	8.6%

B. Tunnel Congestion

Mode splits will also be affected by delays incurred by vehicles on the Artery or at the tunnels. To determine the impact of increased congestion delay, some of the above configurations were run again, but with the addition of 10 minute travel delays on all modes using highway access facilities. The highway penalty resulted in estimated mode split increases as follows:

Blue Line to Red Line	from 6.8 to 9.0 percent
Blue Line to Red plus Blue Line to Logan	from 8.6 to 11.4 percent

C. Transit Transfer Penalty

Since the model does not appear to be sufficiently sensitive to transit transfer time, an increased transfer time sensitivity was incorporated into the model to more adequately reflect the full benefits to the Logan passengers of eliminating transfers. The inclusion of the increased transfer sensitivity into the model resulted in mode split estimates as follows:

Blue Line to Red plus
Blue Line to Logan
w/ increased transfer sensitivity from 8.6 to 10.3 percent

D. Combination of Tunnel Congestion and Increased Transfer Time Sensitivity

When the highway delay penalty and the transfer time sensitivity are combined, the potential mode split of Logan passengers for the configurati that reflects Alewife, a Red/Blue Line link and a Blue Line spur to Logan, results in an estimated mode split of 13.6 percent.

Table A presents the mode split results in summary fashion, along wit the percentage increases in Logan passenger transit ridership over present conditions resulting from each configuration, and with varying conditions regarding highway and transfer time penalties or sensitivities.

Table A
Summary of Results

	Alternative	# of Additional Logan Passengers over Base Case	Mode Split % of Passengers to/from Logan Using the T	Mode Split % Increase ove the Base Case
	Base Case	--	6.57	--
Transit Improvements				
Alewife Ext.	Case 1	-21	6.63	1%
Case 1 plus Blue to Charles	Case 2	68	6.77	3%
Case 2 with Bowdoin closed	Case 2a	106	6.89	5%
Case 2 plus Blue to Logan	Case 3	682	8.60	31%
Alewife plus Blue to Park, plus Blue to Logan	Case 4	695	8.63	31%
With Highway Penalties				
Alewife Ext.	Case 5	748	8.79	33%
Transit as in Case 4	Case 6	1627	11.40	75%
With Transfer Sensitivity				
Transit as in Case 4	Case 7	1239	10.25	56%
Highway Penalty and Transfer Sensitivity				
Transit as in Case 4	Case 8	2369	13.60	107%

CTPS

central transportation planning staff
27 school street boston massachusetts 02108 (617) 451-57

MEMORANDUM

TO: Third Harbor Crossing Files May 24, 1982

FROM: Cathy Buckley Cathy Buckley

RE: Logan Airport Ground Traffic in the Year 2010: Three Scenarios

The amount of ground traffic generated by Logan Airport in 2010 will depend upon two major factors: 1) the activities going on at Logan and 2) the methods used by people to reach the airport. Massport has developed a forecast of Logan activities (enplanements and air cargo) to the year 2010.[1] That forecast of Logan activity is the basis for projecting ground traffic.

The translation of Logan activities into ground traffic depends on the second factor cited above: methods used to rea Logan. The ways in which people approach and leave Logan are described compactly by 1) mode split - how many people use each of the various modes available, and by 2) vehicle occupany rates - how many individuals are in each vehicle type, on average.

Each of the three scenarios described in this memo contais a set of assumptions about mode splits and vehicle occupancy rates. Each different set of assumptions will, in turn, be applied to the same forecast of Logan activities, resulting in three forecasts of Logan-related ground traffic for 2010.

The three scenarios, briefly stated, are 1) 1979 mode split and vehicle occupancy rates continued, 2) moderate increases in public transportation and vehicle occupancy, and 3) maximum diversion to public transportation.

I. Scenario I: Present Situation Extended

In this case, it is assumed that, twenty-eight years from today, trips to and from Logan will exhibit the same mode splits and vehicle occupancy rates as occurred in 1979.

To develop an AWDT for 2010, it is necessary to develop factors that translate 1979 activities into 1979 ground traffic. These activity to traffic factors can then be applied to the activities forecast for 2010 to derive traffic estimates for 2010.

The following table indicates the levels of activity and associated ground traffic (AWDT) for 1979, the forecast of activity for 2010 and the projected Scenario I ground traffic for that year.

	1979			2010	
	Activity	Associated Ground Traffic[2]	AWDT/ Unit Activity	Activity	Associated Ground Traffic
Annual Enplanements	7,609,540	24,977	.0033	12,610,900	41,616
Employees	12,100	10,327	.8535	15,200	12,973
Annual Air Cargo Tonnage	285,614	942	.0033	675,891	2,230
Bird Island Flats[3]	-	-	-	-	1,081
		36,246			57,900

As indicated in the table, by 2010, enplanements will increase 66 percent over 1979, Logan employment will grow 26 percent, and air cargo tonnage will be 137 percent higher. This growth would increase the AWDT at Logan by 60 percent over 1979, and 78 percent over the 1977 AWDT of 32,550.

In 1977, of all inbound Logan traffic, 19.9 percent entered during the AM peak period and 19.3 percent entered during the PM peak period. Of all outbound traffic, 13.5 percent left during the AM peak period and 22.2 percent exited during the PM peak period. If those proportions were to prevail in 2010, the following volumes would occur:

2010	AM (7-10)	PM (3-6)	AWDT
in	11,522	11,175	57,900
out	7,816	12,854	57,900

II. Scenario II: Moderate Increases in Public Transportation, Vehicle Occupancy Rates

As indicated in the preceding section, if 1979 mode splits and vehicle occupancy rates continue to 2010, then the AWDT entering Logan would increase 78 percent over the 1977 level. If no new tunnel were constructed, then a significant increase in traffic congestion would occur. It seems reasonable to assu that, at least in the No Build circumstance, mode splits and vehicle occupancy rates would change in light of increased traffic congestion.

In Scenario I, the derivation of ground traffic for 2010 was a simple procedure. This scenario is much more involved. First, the relative split among the seven major modes used by passengers will be modified. Then the average vehicle occupanc rates for six of those modes will be changed (this rate does not apply to rapid transit). Then the same process must be followed for employees.

The changes in modal split and vehicle occupancy rates will be based primarily on information obtained in the Logan Airport surveys of 1970 and 1979.

A. Air Passengers

The following table shows air traveler modal split to Logan for 1970 and 1979, as reported in surveys. Also indicate is a forecast of modal split for 2010.

Enplaning Passengers - Ground Mode to Logan (%)

Mode	1970[4]	% Change/ Decade	1979[5]	% Change/ Decade	2010
Private Car	60.9	-10.7	54.4	-04.8	46.5
Rental Car	8.2	+37.8	11.3	+03.2	12.4
Limousine	3.5	+45.7	5.1	+16.3	7.6
Taxi	18.1	+08.3	19.6	+03.4	21.6
Rapid Transit	6.7	-06.0	6.3	+03.2	6.9
Other Bus	-	+32 plus	3.3	+17.2	5.0
Other	2.5	-	-	-	-
	99.9		100.0		100.0

In the 1970 survey, "other bus" was not tabulated, but was included within "other," which constituted 2.5 percent of person-trips. The growth of "other bus" from 1970 to 1979 is, therefore, at least 32 percent, which assumes all "other"

trips were by "other bus." The actual growth in "other bus" was probably much higher. Significant increases also occurred in the use of limousines and rental cars between 1970 and 1979. These increases were primarily at the expense of the private car.

In projecting modal share to 2010, the trends developed from 1970 to 1979 were used as the basis. The most significant increases occur for limousine and "other bus" shares, each of which increases 50 percent over its 1979 share. Three modes, rental car, taxi, and rapid transit, are increased 10 percent over their 1979 shares. The private automobile share decreases 14.5 percent in the thirty-one years between 1979 and 2010.

As indicated in the table above, the direction of change for each mode's share is projected to be the same from 1979 to 2010 as it was from 1970 to 1979 (except for rapid transit). The magnitude of the change from 1979 to 2010 is forecast to be less than occurred from 1970 to 1979.[6]

Although the rapid transit share decreased from 1970 to 1979, the increasing future traffic congestion led to a 2010 rapid-transit share slighly higher (3 percent) than occurred in 1970.

Vehicle occupancy rates were also modified. The following table indicates actual and assumed rates for 1970, 1979, and 2010, by mode. Assumed rates are in parentheses.

Vehicle Occupancy Rate

Mode	1970	1979	2010
Private Car	-	(0.73)	(0.76)
Rental Car	(1.2)	(1.2)	(1.3)
Limousine	4.0	3.6	(4.0)
Taxi	0.76	0.74	(0.74)
Other Bus	-	(9.7)	(10.7)

The taxi and limousine rates were derived from survey data and classification counts: the number of person-trips by mode divided by the number of vehicles (either taxi or limo) equals the average vehicle occupancy rate. The limo rate decreased 10 percent from 1970 to 1979 and is projected to increase 10 percent to 2010. The taxi rate decreased slightly from 1970 to 1979 and is projected to hold steady for 2010.

The rental car occupancy rates for 1970 and 1979 were assumed to be 1.2. This is assumed to increase 10 percent for 2010. The 1979 "other bus" rate was also an assumption, becau the number of buses was not collected directly in the 1979 classification counts. This rate is assumed to increase 10 percent by 2010.

Deriving these rates for the private car is more involve A distinction must be made between cars parked at Logan and cars driven away by a companion. In the former case, the auto occupancy rate is straightforward: it is the average number of air travelers per parked automobile. In the latter case, the automobile drops off air passengers and then leaves the airport with none. Assume, for example, that someone drives to Logan, drops off three air travelers, and drives ho alone. The average air-traveler occupancy rate would then be three air travelers for the first trip plus zero air travelers for the second trip averages to 1.5 air travelers for the two trips.

The derivation of the overall vehicle occupancy rate depends therefore, on three factors: 1) the split between cars parke at Logan and driven away by a companion, 2) the assumed avera number of air passengers per parked car, and 3) the assumed average number of air travelers per car driven away by a companion. The next table gives trips to Logan for 1979 and 2010. In parentheses are the assumed number of air travelers per vehicle.

Person-Trips, Air Travelers to Logan

Private Car	1979[7]	2010
Parked at Logan	36.6% (1.2)	40.0% (1.3)
Driven Away	63.4% (1.2)	60.0% (1.2)
	100.0%	100.0%

The overall vehicle occupancy rate for the private car i developed as follows, using 1979 data. Assume 1,000 air travelers arrive at Logan by private car. According to the 1979 survey 36.6 percent, or 366, came in cars that were parked at Logan. If there were 1.2 air travelers per car, the 366 travelers came in 305 automobiles. The other 634 air travelers came in cars driven away by a visitor. At 1.2 travelers per car, 528 car

were required. But these 528 cars came in and then left the airport and made 1,056 trips. In total, the 1,000 air travelers generate 305 plus 1,056 equals 1,361 vehicular trips. The number of air travelers per vehicular trip, or overall vehicular occupancy rate, is 1,000 person-trips divided by 1,361 vehicular trips, or 0.73. The same method is used to calculate the vehicle occupancy rate for 2010.

While the assumed number of air travelers per vehicle (1.2 or 1.3) is important, the overall occupancy rate is, practically speaking, more dependent on the ratio of air travelers' cars parked at Logan. (The only way cars dropping off travelers could be as efficient as those parked at Logan would be if they carried twice as many air travelers on average). Common sense would suggest that increased levels of congestion would cause a greater proportion of private cars to be parked at Logan. If the car is parked at Logan, it only has to travel half the distance and visitors are spared the frustration engendered by traffic jams. The split in 2010 will be affected in large measure by Massport policies, ranging from the cost and availability of parking to the imposition of tolls for vehicles entering the airport. In this 2010 scenario, a 9 percent increase in the proportion of private cars parking and a 10 percent increase in the number of air travelers in those cars are assumed.

It was determined that in 1979 an additional 452 vehicles entered Logan on a daily basis carrying no air travelers but only visitors. In proportion to the number of projected air travelers for 2010, this number would increase to 750 vehicles.

At this point, the total number of enplaned passengers on an average weekday in 2010 must be estimated. The percentage of air travelers by each mode can then be translated into the number of air passengers by mode. In 1979, an average 17,449 air travelers traveled to Logan by ground on a daily basis, resulting in an ADT of 23,352.[8] When ADTs were converted to AWDTs, this 23,352 ADT became an AWDT of 24,977, or 7 percent higher. Therefore, the assumed average weekday number of enplaned passengers for 1979 would be 17,449 plus 7 percent, or 18,670. This number is then multiplied by the ratio of 2010 to 1979 enplanements (12,610,900/7,609,540) to arrive at an average weekday number of enplaning passengers for 2010 of 30,940.

The following table indicates the projected air traveler person-trips and resulting vehicle trips for 2010, by mode.

Mode	2010 Air Traveler Person-Trips	AWDT (one-way)
Private Car		
parked	5,755	4,427
driven away	8,632	14,387
visitors only	0	750
Rental Car	3,837	2,952
Limo	2,351	588
Taxi	6,683	9,031
Rapid Transit	2,135	0
Other Bus	1,547	145
	30,940	32,280

There are also truck trips engendered by air passenger activity. It will be assumed that trucks related to air passenger activity (non-cargo trucks) will come to Logan according to the formula developed by Massport.[9]

annual entries = 0.070 x annual passengers

For 2010, this formula yields 1,765,526 annual non-cargo truck entries. This annual figure is then divided by 341 to yield an AWDT of 5,177 trucks (This is 7 percent higher than the truck ADT of 4,837.).

In total, the 2010 AWDT related to passengers is 32,280 plus 5,177 or 37,457.

B. Employees

In 2010, Logan Airport is projected to have 15,200 employees. On an average weekday, 71.5 percent, or 10,868 will come to work.[10]

The following table indicates the mode split of employees trip to work, as found in 1970, 1979 and projected for 2010.

Person-trips (%)

	1970	1979	2010
Private Car	85.5	(88.1)	(86.8)
drive		81.3	65.0
passenger		6.8	21.8
Transit	11.4	8.3	9.1
Walk		0.4	0.6
Taxi		0.3	0.3
Motorcycle		1.0	1.5
Other	3.1	1.7	1.7
	100.0	100.1	100.0

Although transit share declined over 27 percent from 1970 to 1979, it is projected to increase by 10 percent from 1979 to 2010. Walk and motorcycle modes are projected to increase 50 percent, with the category "other" remaining the same.

While the percentage of workers using the private automobile to get to work will not change significantly, a larger proportion of those employees are projected to be passengers. The following table indicates the number of person- and vehicle-trips made by employees in 1979 and projected for 2010, using the private automobile.

	1979[11]		2010	
Private Car	Person-Trips	Vehicle Trips	Person-Trips	Vehicle Trips
Drive	6,858	6,858	7,064	7,064
Passenger	(576)		(2,369)	
-drop off	202	368	373	622
-carpool	374	0	1,996	0
TOTAL	7,434	7,226	9,433	7,686

In 1979, it was assumed that 35 percent of the passengers were driven to Logan by non-employees, engendering round-trips, and that the vehicle-occupancy rate was 1.1. For 2010, this proportion was cut by more than 50 percent and the vehicle-occupancy rate was raised to 1.2.

For all employees coming to work by private automobile, the vehicle-occupancy rate was raised by twenty percent, from just over 1.0 to just over 1.2.

The following table indicates the person- and vehicle-trips by employees to work on an average weekday, for all modes

Average Weekday Mode to Work	2010 People	Trips
Private Car	9,433	7,686
Transit	989	0
Walk	65	0
Taxi	33	42
Motorcycle	163	136
Other	185	92
TOTAL	10,868	7,956

For taxi, it was assumed that 50 percent of the trips were deadhead (round-trips) and that the passenger occupancy rate was 1.2. An occupancy rate of 1.2 was also assumed for motorcycles. The "other" category was assumed to create 50 percent as many vehicle trips as person-trips.

In 1979, employees made 35 percent as many trips during mid-shift as in getting to work. Assuming this occurs in 2010 the 7,956 trips increased by 35 percent yield an AWDT of 10,74

In 1979, the number of inbound trips per employee on an average weekday was almost 1.3. In 2010, it is projected to be just under 1.0.

C. Air Cargo Trucks

It is assumed that traffic congestion will not decrease the truck traffic associated with air cargo. Therefore, the air cargo truck traffic for 2010 will be the same under Scenario II as under Scenario I: a one-way AWDT of 2,230 trucks.

D. Bird Island Flats

The projections developed for Bird Island Flats already incorporated mitigating factors, in light of anticipated traffic congestion. These mitigative measures include increased use of transit and an employee car occupancy rate of 1.4.[12] The trips associated with Bird Island Flats under this scenario will, therefore, be the same as under Scenario I: an AWDT of 1,081 entering vehicles.

E. Total

The following table indicates the trips associated with each activity for the year 2010 under Scenario II.

Activity	2010 One-Way AWDT
Passenger-related	37,457
Employees	10,741
Air Cargo	2,230
Bird Island Flats	1,081
TOTAL	51,509

Assuming the same proportions of entering and exiting traffic during peak periods as occurred in 1977, the following volumes are obtained for 2010:

2010	AM (7-10)	PM (3-6)	AWDT
In	10,259	9,950	51,509
Out	6,944	11,429	51,509

III. Scenario III: Maximum Diversion to Transit

In 1980, an analysis of Logan Airport ground transportatic was done for Massport by Jeff MacMann of Cambridge Systematics, Inc.[13] That analysis included an estimate of how many trips could be diverted to transit, given significant improvements to the transit system. That estimate is used here to represent the maximum diversion to transit that would be apt to occur, given no new tunnel.

A. Passengers

This scenario assumes major improvements to the Blue Line, including a direct connection to the Red Line.[14] This could occur at Charles Street or Park Street Station. State Street Station would be improved to facilitate the Blue-Orange transfe. On the airport end, the Blue Line could come in on a spur to a central location, with moving sidewalks to the passenger termi. Blue Line cars and escalators would be equipped to serve peopl carrying luggage.

In addition to the improved transit service, this scenaric includes some disincentives to use of the automobile. The cost of parking would be doubled. To discourage pickup/dropoff, an airport access toll of $3 would be imposed.[15]

Suburban bus and limousine service also would be improved. Finally, a downtown terminal would be built to allow air passengers to check in before arriving at Logan.[16]

Under this maximum diversion scenario, the following mode splits are predicted for air passengers. The 1979 mode splits are included to allow comparison.

	Mode Split		2010	
Mode	1979	2010[17]	Person-Trips	Vehicle Trips
Private Car	(54.4)	(39.0)		
-park	19.9	25.0	7,735	5,525
-driven away	34.5	14.0	4,332	6,665
Rental Car	11.3	8.0	2,475	1,768
Bus-Limo	8.4	16.0	4,950	678
Taxi	19.6	15.0	4,641	5,730
Rapid Transit	6.3	22.0	6,807	0
TOTAL			30,940	20,366

The air passenger person-trips (30,940) were developed earlier in this memorandum.

The translation of person-trips to vehicle-trips was done assuming that the vehicle-occupancy rates would be 10 percent higher than was assumed under Scenario II. That assumption results in the following vehicle-occupancy rates:

Vehicle-Occupancy Rates

Mode	Scenario II	Scenario III
Private Car		
-parked	1.3	1.4
-driven away	1.2	1.3
Rental Car	1.3	1.4
Bus	10.7	(11.8) 7.3
Limo	4.0	(4.4)
Taxi	0.74	.81

The bus-limo occupancy rate is a weighted average of the two rates, weighted according to the 1979 relative use of those two modes.

The trucks associated with passenger activity will result in an AWDT of 5,177, as occurred under the other two scenarios.

B. Employees

Employees under this scenario will be affected by improvements and penalties described above. In addition, they will receive transit fare subsidies. Those who form carpools and vanpools will not pay for parking. The parking price for others will double.

The following is an estimate of the mode split, person-trips, vehicle-occupancy rates, and vehicle-trips for employees.

2010

Mode	Mode Split(%)[18]	Person-Trips	Vehicle Occupancy Rate[19]	AWDT(to work)
Drive Alone	56	6,086	1.0	6,086
Shared Ride	22	2,391	2.2	1,087
Bus-Limo	5	543	7.3	74
Vanpool	2	217	7.1	31
Rapid Transit	14	1,522	-	0
Other	1	109	2.0	54
TOTAL	100	10,868[20]		7,332

These 7,332 trips should be increased by 35 percent to reflect mid-shift travel. The total one-way AWDT is then 9,89[illegible] trips.

C. Air Cargo Trucks

The air cargo truck AWDT will be the same as estimated in Scenarios I and II: 2,230 (one-way).

D. Bird Island Flats

The AWDT associated with Bird Island Flats will be assume[illegible] to be the same as occurred in Scenarios I and II: 1,081 (one-way).

E. Total

The total one-way AWDT for this scenario is the following

Activity	2010 AWDT (one-way)
Passenger-related	25,543
Employees	9,898
Air Cargo	2,230
Bird Island Flats	1,081
TOTAL	38,752

Applying the peak period to AWDT ratios found in 1977 results in the following volumes:

2010	AM	PM	AWDT
In	7,712	7,479	38,752
Out	5,232	8,603	38,752

IV. Comparison of Three Scenarios

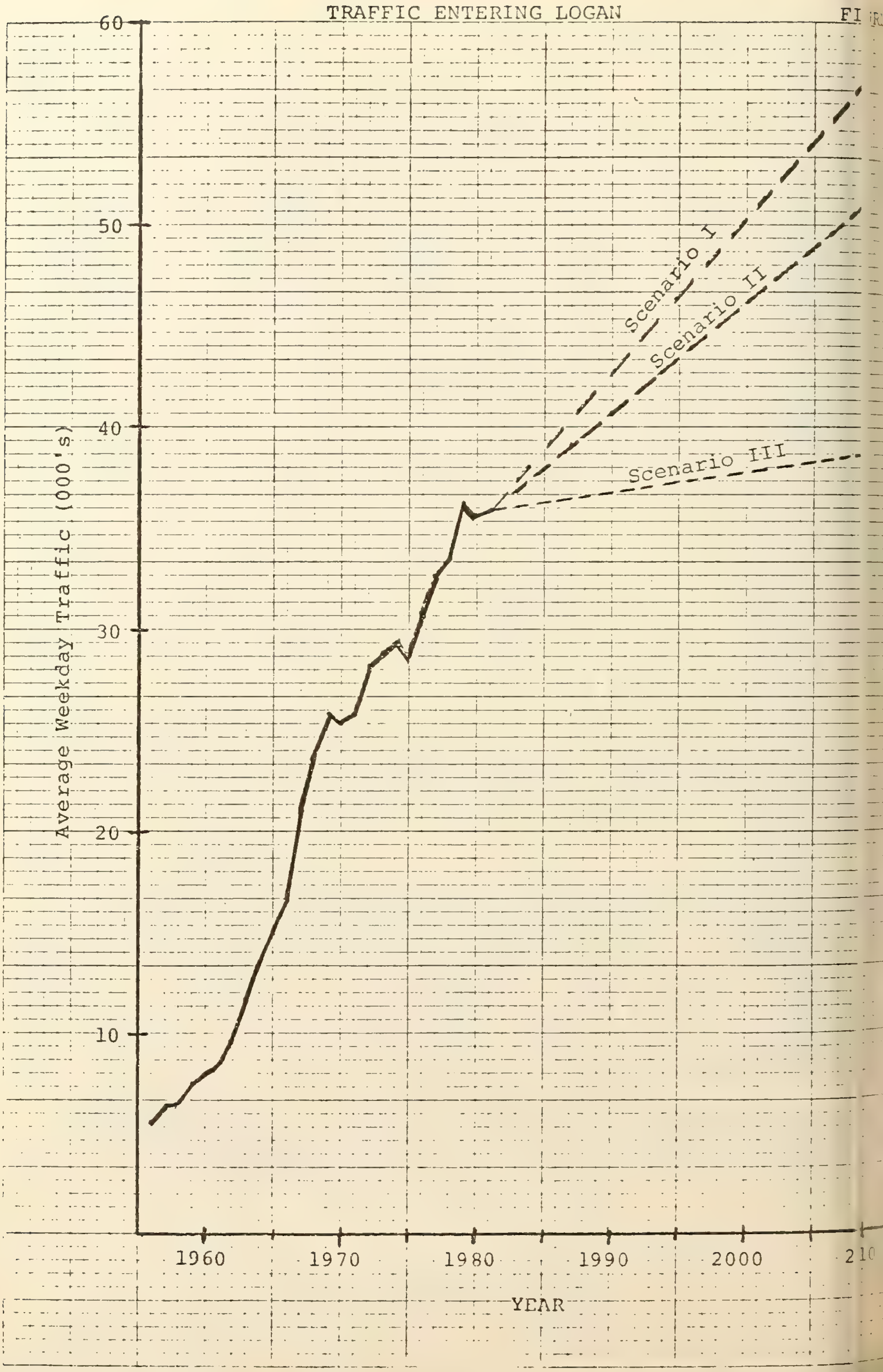
The following table indicates the AWDT for 1977 and the estimated 2010 AWDT for each scenario:

Scenario	2010 AWDT (one-way)	Increase Over 1977	
1977 Base	(32,550)	#	%
I.	57,900	25,350	78
II.	51,509	18,959	58
III.	38,752	6,202	19

If the methods used to reach Logan in 1979 are in effect in 2010 (Scenario I), then 25,350 extra trips will enter Logan on an average weekday. Under Scenario II, approximately 75 percent of that growth will occur. Under Scenario III, only 25 percent of that growth is predicted. These results are shown graphically in Figure 1.[21]

The purpose of preparing these forecasts of Logan Airport traffic is to develop a better understanding of the future implications of building or not building a new tunnel. In performing traffic forecasting, it is standard practice to include only those major capital projects that have been committed. Scenario III assumes, among other things, a connection between the Blue and Red Lines, a major capital project for which no commitment has been made. It is inappropriate, therefore, to use the forecast developed under Scenario III in this study.

Scenarios I and II are reasonable, under different circumstances. If no new tunnel is built, it is unlikely that 1979 mode splits and vehicle occupancy rates would occur thirty-one years later. In less than a third of that time,


TRAFFIC ENTERING LOGAN
FI
Average Weekday Traffic (000's)
60
50
40
30
20
10
Scenario I
Scenario II
Scenario III
1960
1970
1980
1990
2000
YEAR

between 1970 and 1979, methods of getting to the airport changed substantially. Given the increasing congestion likely to occur without a new tunnel, Scenario II is more likely than Scenario I.

If a new tunnel is constructed, then there would be sufficient traffic capacity to allow Logan users in 2010 to reach the airport, as they did in 1979. Given a new tunnel, then, Scenario I is more likely than Scenario II.

The outcomes of the calculations in this memo are predictions of traffic levels in the year 2010. These predictions are expressed as specific numbers such as AWDT's of 57,900 or 51,509. There is an implied degree of accuracy of these numbers that is not warranted by the analysis. Each future projection is based on at least thirty-four assumptions,[22] each of which has its own potential error properties. To the extent that the assumptions are reasonable, the projections also are appropriate. The degree to which any or all of the assumptions turn out to be inaccurate over the next twenty-eight years will be reflected in actual traffic growth.

CB:sb:mh

Attachments: footnotes

FOOTNOTES

[1] See C. Buckley, "Forecasts of Activity at Logan Airport and Bird Island Flats," CTPS memo, April 27, 1982.

[2] See C. Buckley, "Logan Airport Traffic for the Base Year (1977" May 19, 1982.

[3] Massport, Proposed Development of Bird Island Flats, Revised EIR Appendix, April 30, 1982, p. B-4-11. It was suggested by Norm Faramelli of Massport that the figure of 1,081 AWDT was a reasonable one in light of projected development at Bird Island Flats (telephone, May 18, 1982).

[4] Coverdale and Colpitts, "Report on Logan Airport Travel Study, prepared for BTP&D, MDPW, October 31, 1972, Table I, p. 35, with air transfers eliminated.

[5] Cambridge Systematics, Inc., "Air Passenger Survey General Tabulations," prepared for Massport, April 5, 1980, Tables 16 and 52, with unknowns and air transfers eliminated.

[6] If the magnitude and direction of change for each mode from 1970 to 1979 were continued exactly, 2010 model shares would be the following (where each share was reduced proportionately so the total came to 100 percent): private car - 30.7, rental car - 23.5, limo - 12.5, taxi - 21.4, rapid transit - 3.9, other bus - 7.9. While the magnitude of the 1970 to 1979 trends may continue, it was thought to be more reasonable to modify them.

[7] CSI Air Passenger, Survey, Tables 17 and 18.

[8] C. Buckley, CTPS, "Ground Traffic Generated by Logan Activiti," May 5, 1982, pp. 5, 6.

[9] Joe Brevard, Massport, "Calculating Logan Ground Vehicle Entr s as a Function of Aviation - Based Activity Forecasts," p. 6.

[10] CSI, Employee Survey, Table 7.

[11] C. Buckley, CTPS memo, May 5, 1982, p. 7. The numbers in the memo have been multiplied by 71.5 percent to reflect average weekday values.

[12] Massport, Revised Final EIR Appendix, p. B-4-4.

[13]Jeff MacMann, CSI, "Logan Airport Ground Transportation Alternatives," June 17, 1980.

[14]MacMann, pp. 13-14.

[15]MacMann, p. 17.

[16]MacMann, p. 16. Another alternative discussed was a ferry to provide access between Logan and downtown Boston.

[17]MacMann, Table 2, bottom line of chart.

[18]MacMann, Table 3, with parking price incentives.

[19]MacMann, Table 3, bottom line.

[20]This is 15,200 employees times average weekday force of 71.5 percent.

[21]The AWDT's entering Logan from 1956 to 1976 are estimates, based on annual enplanements. The formula used is entering AWDT = .00538 x annual enplanements. This formula was developed by examining the relationship between enplanements and AWDT's for 1970 and 1977. For data, see Tom Lisco, "Preliminary Estimates of Third Harbor Crossing Traffic," July 27, 1979, Table A-4.

[22]Four assumptions about Logan activities: passengers, employees, air cargo, Bird Island Flats. Two assumptions to translate the latter two into trips. Seven assumptions about air passenger modal splits, six about their vehicle occupancy rates, one about associated truck traffic. Seven assumptions about employee modal shift, six about their vehicle occupancy rates, one about mid-shift travel.

MEMO TO: Joe Brevard, Norm Faramelli, Ted Baldwin and Peter Sheinfeld, Massport

FROM: Bill Jessiman and Jeff MacMann, CS

DATE: August 26, 1981

RE: Pilot Analyses of Airport Passenger/Companion Access Alternatives

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I. Summary

The final product of the Logan Airport Access travel survey and trave demand model development efforts is an access forecasting model. This mod is capable of predicting the distribution of employees, travellers, and well-wishers among access modes under a variety of access management alter tives. The purpose of this memo is to present the results of the travelle/ companion forecasting model as it was applied to six prototypical access alternatives:

1. Garage parking price decrease
2. Overall parking price increase
3. Addition of a new, on-airport remote access parking facility
4. Constrained parking demand by increasing pricing for short-term parking
5. Constrained parking demand by increasing pricing for long-term parking
6. Improved express bus and limousine service to the airport.

These results are intended to demonstrate the access forecasting mod, the range of alternatives it can analyze, and the variety of outputs it c provide; the results are not intended to be an end in themselves. Hopefuly,

they will stimulate the design of more comprehensive access management strategies where the negative features of one component can be offset by the addition of another component to the alternative.

II. Background

In the spring of 1979 a comprehensive ground access survey of all users of Logan Airport was undertaken. (The access modes of employees have been presented and analyzed elsewhere and will not be discussed here). Reference tabulations of all travellers and companions by access mode, time-of-day, origin, etc. were presented in a series of earlier reports. This passenger/companion survey forms the basis of the access forecasting model presented here.

First, that survey provided the basic socioeconomic, circumstantial (baggage, auto available, etc.) and locational information about all travellers and companions and their actual access choices. This information was used to estimate or calibrate the access forecasting model, i.e., capture the various time versus cost tradeoffs made by travellers/companions under different circumstances. All told, ten individual travel behavior models were estimated which collectively fit together to cover all market segments and all access decisions variables. These models were then combined into four forecasting models, one for each of the following four market segments which were felt to behave differently from one another:

- local area residents, business travel
- local area residents, pleasure travel
- out-of-town travellers, business travel
- out-of-town travellers, pleasure travel

The traveller/companion survey was then used twice more, once in mod validation and again in forecasting the overall response to each particul access management alternative. In both situations the individual observa (travellers with companions, if any) are preserved in terms of their soci- economic, circumstantial, and locational specifics. Altogether there are 12,000 individual travellers (enplaning passengers) in the survey file, s that they collectively represent over 60 percent of an average day's acti- ities at Logan, a highly reliable sample statistically.

In validating the forecasting system, the appropriate one of the fo market-segment-specific forecasting models was run for each observation (individual traveller) to estimate that traveller's probability of choos ig each of the available access modes. Base case (existing access) conditi s were preserved as were the traveller's unique socioeconomic, circumstanta and locational characteristics. These probabilities were then aggregate across all travellers in a given market segment, and the aggregate resul s compared with actual aggregate choices and ground counts. This process as used to adjust and refine the models and expansion procedures until a c se correspondence was achieved.

In forecasting the response to a given access alternative, a simil procedure is used. The traveller survey data base is used again, and t a propriate market segment model used to predict each traveller's probabiliti of choosing the various access modes under the altered access condition described by each access alternative, for example, improved limousine/b s vice or a new T extension to the airport. The forecasting model (heraft the four market-segment-specific forecasting models will be referred to in general as "the forecasting model") then sums up the responses to the ter

access conditions over all travellers in the file and scales them up to the full universe of enplaning passengers for an average day in April, 1981. The forecasting model then produces the outputs listed in Table 1 for each access alternative analyzed, enabling a side-by-side comparison with the base case.

III. Results

Overall, of course, it is in everyone's economic best interests to make airport access as attractive as possible to attract as many users to Logan as possible. Within that general goal, there are a number of specific objectives in improving access to Logan Airport:

1. From the traveller's point of view, improve the time, cost, and convenience associated with reaching Logan Airport. Different travellers (market segments) will place different emphases on time, cost, and other amenities.

2. From the traveller's point of view, make alternative access modes available to travellers to provide greater flexibility.

3. From an EPA perspective, reduce the number of vehicles parking at Logan.

4. From an energy conservation perspective and a broader air quality perspective, reduce the VMT associated with accessing Logan Airport.*

5. From a public transportation planning point of view, increase the utilization of public transit facilities--MBTA, express bus/limousine, and taxi.

6. From a Massport operations perspective, maximize revenues (or minimize losses) associated with providing access facilities, notably running Massport bus service and parking facilities.

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*If a single round trip to Logan where the traveller parks his/her car at Logan is replaced with two round trips, one to drop off the traveller and another to pick the traveller up upon his/her return, air quality and energy conservation objectives have not really been served even if parking is reduced.

TABLE 1

SUMMARY OF OUTPUTS PRODUCED BY LOGAN AIRPORT ACCESS FORECASTING MODEL

1. <u>Air Passenger Person-Trips</u>
   a. Main Mode Summary
      - by market segment
        - business/local
        - business/non-local
        - pleasure*/local
        - pleasure/non-local
      - by main access mode
        - MBTA
        - express bus/limousine
        - taxi
        - rental car
        - auto accompanied by non-travelling companion(s)
        - auto unaccompanied
   b. Rental Car Access Further Breakdown (by market segment)
        - off-airport
        - on-airport, non-Big 3
        - Big 3 (Hertz, Avis, National)
   c. Auto Accompanied Breakdown (by market segment)
        - curb
        - meter
        - garages
   d. Auto Unaccompanied Breakdown (by market segment)
        - on-airport garage
        - park/fly lot
        - on-airport remote lot (in one alternative only)

2. <u>Vehicle Trips</u>
   a. Main Mode Summary
      - by market segment
        - business/local
        - business/non-local
        - pleasure/local
        - pleasure/non-local
      - by main access mode
        - MBTA
        - express bus/limousine
        - taxi
        - rental car
        - auto accompanied by non-travelling companion(s)
        - auto unaccompanied

*"Pleasure" is really "non-business".

b. Rental Car Access Further Breakdown (by market segment)
- off-airport
- on-airport, non-Big 3
- Big 3 (Hertz, Avis, National)

c. Auto Accompanied Breakdown (by market segment)
- curb
- meter
- garages

d. Auto Unaccompanied Breakdown (by market segment)
- on-airport garage
- park/fly lot
- on-airport remote lot (in one alternative only)

3. <u>Companion Person-Trips</u>

a. Main Mode Summary
- by market segment
  - business/local
  - business/non-local
  - pleasure/local
  - pleasure/non-local
- by main access mode
  - MBTA
  - express bus/limousine
  - taxi
  - rental car
  - auto accompanied by non-travelling companion(s)

b. Rental Car Access Further Breakdown (by market segment)
- off-airport
- on-airport, non-Big 3
- Big 3 (Hertz, Avis, National)

c. Auto Accompanied Breakdown (by market segment)
- curb
- meter
- garages

4. <u>Air Passenger Consumer Surplus</u>* (by market segment)
- dollars
- time

5. <u>Highway VMT</u> (by market segment)
- by mode
- dead-head non-Boston taxi VMT

6. <u>Aggregate Air Passenger Cost</u> (by market segment, by mode)

7. <u>Aggregate Air Passenger Time</u> (by market segment, by mode)

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*See text for definition.

8. Public Transportation Access Revenues (by mode, by market segment)

- MBTA
- Massport bus
- Express bus/limousine
- taxi

9. Parking Revenues (by market segment)

- meter
- garages
    - auto accompanied
    - auto unaccompanied
- park/fly lots

10. Peak Parking Occupancy (vehicles)

- meter
- garages
    - auto accompanied
    - auto unaccompanied

7. From a Massport operations perspective, minimize congestion at on-airport transportation facilities--roadways, parking lots, and curbside space. Improve efficiency in order to serve the greatest number of users with existing and proposed facilities.

While these are all legitimate objectives, they are frequently in conflict with one another. For example, raising long-term parking prices may reduce the parking demand at Logan's garages, increase the use of public transit to Logan, and even increase revenues for Massport. However, it may also lead to a major switch to the drop-off (auto accompanied) mode which would double VMT for such travellers and present major congestion problems at terminal curbsides.

To evaluate an access alternative, the degree to which it achieves each of these objectives must be measured or predicted. The forecasting model provides these particular output measures plus a number of additional outputs; however, it is up to the policy- and decision-makers to decide what weights to assign to each of these measures, i.e., the relative emphasis to assign to each of these objectives. The complete set of outputs for the base case and each of the six pilot access alternatives is included in Appendix A. For purposes of a more concise summary of each access alternative the following six figures of merit have been selected as being of particular interest to reflect the achievement of the stated objectives:

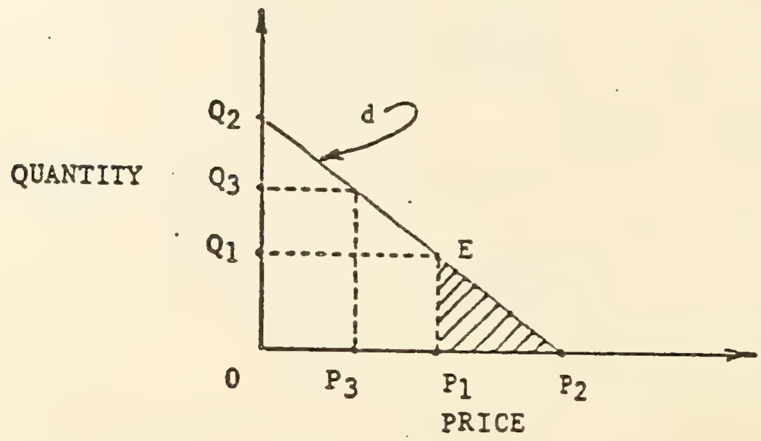
1. Overall access mode split

2. Overall private vehicle trips to Logan Airport

3. Highway VMT (Vehicle Miles of Travel) (Note: there is a direct relationship between vehicle miles of travel and both quantity of air pollutants and fuel consumed)

4. Number of vehicles parking at Logan
   - garages
   - meters
   - curbside

5. Change in consumer surplus, an economic measure of overall user benefit from a particular access alternative. Consumer surplus is defined as the area under the demand curve or the "extra" utility afforded all consumers (travellers) by a particular (access) alternative. Consider a simple demand curve, d:



This demand curve relates the quantity of a commodity that will be purchased to its price. If the price at equilibrium is P_1, then Q_1 units will be consumed. The economic value of this equilibrium is the product Q_1 times P_1 or, graphically, the rectangular area OQ_1EP_1. However, a number of consumers would have been willing to pay more, i.e., if the price were greater than P_1, some of those Q_1 units would still be consumed because they have a value or utility to some consumers greater than the equilibrium price. In the aggregate, the shaded triangular area P_1EP_2 represents the total extra utility derived by all consumers if the equilibrium price is P_1. This shaded area is called consumer surplus. If a new alternative lowers the price to P_3 so that Q_3 units are now consumed, consumer surplus has increased. The difference between consumer surplus in the new case and in the previous case represents the increase in consumer surplus or extra utility realized by all consumers attributable to the improved alternative. In the case of travellers accessing Logan Airport, monetary cost is just one of many factors which influence their choice, but the concept is the same; with respect to each factor or variable in the demand model, there is a change in consumer surplus. Because the demand model coefficients provide the relative weights with which travellers trade off one factor or variable versus another (say time versus cost), the aggregate change in consumer surplus or in total utility can be weighted and summed and expressed in terms of any one of the factors. For this

comparison, we have chosen to express change in consumer surplus both in terms of dollars and hours. These are comprehensive measures of the value to all travellers collectively of the improvement (or extra cost) of access to Logan resulting from a particular access alternative.

6. Massport revenues (Massport bus fares plus revenues from Massport parking facilities).

Table 2 summarizes airport access activity for a base case, an average day in April 1981.* In addition to the six selected figures of merit, several other statistics of interest are presented. In terms of the market segment definition, a traveller is defined as being local if he/she is travelling away from home when boarding a flight at Logan. For example, a person is considered local even if he/she came to Logan from Montreal or Vermont by ground mode if he/she is boarding a flight for Florida or Europe.

All travel is counted in one-way trip units, and both trips out of and into Logan are represented. It is assumed that the deplaning access mode is identical to the enplaning access mode, which is all that was surveyed. For example, suppose three local passengers are dropped off at Logan by car by one non-flying companion. This travel party will generate six passenger ground trips, four companion trips (one to drop them off, one to return home, one to pick them up again later, and the fourth to return home with the travellers), and four vehicle trips in the forecast output tables.

The MBTA mode is applicable to any travellers who arrived at/departed from Logan via Airport Station on the Blue Line regardless of what other

*The survey represented April 1979 passengers and travel conditions. However, air passenger traffic was approximately the same in April 1981 as April 1979, so only travel conditions or levels of service have been updated to represent April 1981.

TABLE 2

SUMMARY

MASSPORT - AIRPORT ACCESS
BASE CASE (1981)

1. Air Passenger Trips by Mode Per Day

	T	XBUS/LIMO	TAXI	RENTAL	AUTO ACCOMP	AUTO UNACCOMP	TOTAL
#'s	2,215	3,005	6,648	4,051	11,124	6,647	33,689
(%)	(6.6)	(8.9)	(19.7)	(12.0)	(33.0)	(19.7)	(100.0)

	AUTO ACCOMP: CURB	AUTO ACCOMP: METER	AUTO ACCOMP: GARAGE	AUTO UNACCOMP: GARAGE	AUTO UNACCOMP: PARK-FLY
#'s	6,137	1,389	3,598	6,227	421
(%)	(18.2)	(4.1)	(10.7)	(18.5)	(1.2)

2. Airpax by Market Segment

	#'s	(%)
Business/Local	11,808	(35.0)
Business/non-Lcl	7,667	(22.8)
Pleasure/Local	8,973	(26.6)
Pleasure/non-Lcl	5,240	(15.6)
	33,689	100.0

3. Private Vehicles Using Airport

	CURB	METER	GARAGE	PARK-FLY	TOTAL
#'s	8,570	1,946	9,542	243	20,302
(%)	(42.2)	(9.6)	(47.0)	(1.2)	(100.0)

4. No. Companions Trips: 25,047

5. Highway VMT:

	#'s	(%)
Taxi	66,664	(6.8)
Rental	161,469	(16.6)
A/A	561,510	(57.7)
A/U	183,767	(18.9)
TOTAL	973,410	(100.0)

6. Aggregate Airpax Cost: $317,900 (Different from Consumer Surplus)

7. Aggregate Airpax Time: 36,070 Hours (Different from Consumer Surplus)

8. Massport Revenue

	$	(%)
• Massport Bus	631	(1.5)
• Meter Pkg	973	(2.4)
• Garage Pkg	39,264	(96.1)
TOTAL	40,868	(100.0)

9. Park-Fly Revenue: $ 1,938

access modes or carriers were used prior to using the Blue Line. The express bus and limousine (XBUS or XBUS/LIMO) mode refers to any of the private carrier buses or limousine services to Logan.

The taxi mode includes both metered taxis and share-a-cab. Since non-Boston taxis are not allowed to pick up passengers at Logan, dead-head taxi VMT is included as a separate output in the detailed tables of Appendix A and is included in the VMT totals in the summary tables. The highway VMT figures include mileage for taxis, rental cars, auto accompanied and auto unaccompanied modes in reaching or leaving Logan, but no VMT on Logan circulation roadways.

Consumer surplus figures apply to passengers only, not companions, as do aggregate air passenger (AIRPAX) cost and time. Garage parking includes the Central, Eastern Air Lines and South garages plus the Volpe (International) lot.

Table 3 then summarizes the results of each of the six access management alternatives compared to the base case. For easier digestion, the outputs are expressed in percentage changes from the base case, but, if desired, the actual (daily) numbers can be obtained by looking at the detailed output in Appendix A or by applying the percentage change to the appropriate base case number shown in Table 2.

<u>Alternative 1</u> was an alternative suggested by Joe Brevard of Massport. It involves decreasing the long-term (garage) parking from $6 per day to $4.50 per day. There was no change in short-term parking cost in either the garage or at the meters. The impact of this alternative is to increase the auto unaccompanied mode by 8.5 percent while decreasing the auto accompanied mode by 3 percent, the rental car mode by 0.5 percent, and each of the three public

transportation modes by 1.5 percent - 2.5 percent. Overall garage parking was increased by 2.9 percent, meter parking decreased by 2.7 percent and curb parking decreased by 3.2 percent. Highway VMT was reduced by 0.6 percent, reflecting that the shift from auto accompanied to auto unaccompanied (and thus the saving of the companion's additional trips) was more than enough to offset the shift from transit modes to auto unaccompanied. This accomplishes a real improvement in air quality (despite the increase in garage parking). It also produces a reduction in traffic congestion at Logan by decreasing private vehicle trips by 0.5 percent.

There was a positive change (increase) in consumer surplus reflecting that, overall, passengers receive an increase in value or total utility under this alternative. The increase in consumer surplus measured in dollars is $51,605 and in time 438 hours. Massport garage revenues decrease by just over 12 percent under this alternative and total Massport ground revenues decrease by just under 12 percent (-$4,788 per day). Revenues in the park/fly lot also decrease by 12 percent (not shown in Table 3).

Alternative 2 was a 50 percent increase in parking changes for both long-term (garage) parkers and short-term (garage and meter) parkers. The objective of this alternative was to discourage the use of private automobiles to access Logan and, accordingly, increase the use of public transportation. Indeed MBTA ridership increases by 6.5 percent, bus/limo by 8 percent and taxi by almost 5 percent. Auto unaccompanied goes down by 12.1 percent. Auto accompanied goes down by only 0.6 percent however, reflecting a shift from the use of the garages and meters for short-term parking (down about 50 percent) to the curbside dropoff alternative (a

39.4 percent increase in curbside dropoffs). While VMT is reduced by 1.0 percent in this alternative and public transportation usage is increased, it does strain the capacity of the curbs in the terminal areas.

Consumer surplus is decreased substantially in this alternative relative to the base case (-$184,306 or -1,272 hours), indicating that travellers are going to be disbenefited under this alternative. Despite the 35 percent decrease in parking at paid Massport facilities, Massport revenues still increase by about 13 percent ($5,357 per day) due to the rate increases. This also shows that parking at Logan is relatively price-inelastic, i.e., a 50 percent increase in parking price produced only a 35 percent decrease in parkers, an elasticity of -0.7.

It might also be noted that short-term parkers were much more price sensitive than long-term parkers; short-term parking at the meters and garages decreased by about 50 percent whereas long-term parking (garage) decreased by only 14.2 percent (elasticities of -1.00 and -0.28 respectively). This reflects the availability of the curbside dropoff alternative for the auto accompanied mode. Park-fly lot revenues increased by 34 percent.

Alternative 3 demonstrates the effects of Massport's adding a new, remote parking lot on the airport premises. The parking price charged and shuttle service operated to the terminal were assumed to be the same as at the park/fly lots. This alternative appears to have relatively little impact with respect to any of the access management objectives with 398 passengers (234 cars) per day attracted to the new lot. Public transportation usage decreased slightly (0.6 percent - 0.7 percent); auto accompanied

TABLE 3: ANALYSIS OF ALTERNATIVES (DIFFERENCES FROM BASE CASE)

ALTERNATIVE:	1 (Joe Brevard Parking Price Decrease) A/U Garage → $4.50/day A/A No Change		2 (Bill Jessiman Parking Price-- 50% Increase) A/U Garage → $9.00/day A/A Garage, Meter → $1.50/hr.		3 (On-Airport Remote Parking) Price = Park-Fly Price No Other Changes	
1. AIRPAX ACCESS MODES						
T	-1.8%		+6.5%		-0.6%	
XBUS/LIMO	-2.6%		+8.0%		-0.7%	
TAXI	-1.5%		+4.9%		-0.6%	
RENTAL	-0.5%		+4.1%		-0.2%	
AUTO ACCOMP	-3.0%		-0.6%		-0.8%	
Curb		-3.2%		+39.4%		-0.9%
Meter		-2.7%		-53.5%		-0.7%
Garage		-2.6%		-48.5%		-0.5%
AUTO UNACCOMP	+8.5%		-12.1%		+2.5%	
Garage		+9.5%		-14.2%		-3.3%
Park-Fly		-6.9%		+18.5%		-5.5%
Remote on A/P		NA		NA	+398 Psgrs (234 cars)	
2. VEHICLE TRIPS						
AUTO ACCOMP	-2.9%		-0.6%		-0.7%	
AUTO UNACCOMP	+8.1%		-12.0%		+2.1%	
TOTAL		-0.5%		-1.1%		-0.1%
3. HIGHWAY VMT	-0.6%		-1.0%		-0.1%	
4. VEHICLES PARKING AT LOGAN						
GARAGE PARKING	+2.9%		-31.1%		-1.5%	
METER PARKING	-2.7%		-52.2%		-0.6%	
TOTAL ON A/P		+2.0%		-34.7%		+0.7%
CURB PARKING	-3.2%		+38.3%		-0.8%	
5. CONSUMER SURPLUS (CHANGE)						
Dollars	+$51,605		-$184,306		+$16,966	
Time	+438 hrs.		-1,272 hrs.		+151 hrs.	
6. MASSPORT REVENUES	[illegible]		[illegible]		+$787/day	
	[illegible]		+13.1%		[illegible]	

	(Short-Term Parking Price Penalty) A/A → $1.88/hr.	(Long-Term Parking Price Penalty) A/U → $8.03/day	(Improved Express Bus, Limo Service) (John Martin 7/11/80 Memo)
1. AIRPAX ACCESS MODES			
T	+5.3%	+1.9%	-2.3%
XBUS/LIMO	+5.5%	+2.8%	+28.8%
TAXI	+3.5%	+1.7%	-1.9%
RENTAL	+4.8%	+0.6%	-1.6%
AUTO ACCOMP	-7.0%	+3.1%	-2.8%
Curb	+47.4%	+3.5%	-2.9%
Meter	-76.6%	+2.9%	-2.7%
Garage	-72.8%	+2.4%	-2.6%
AUTO UNACCOMP	+1.0%	-9.1%	-4.4%
Garage	+1.0%	-10.5%	-4.5%
Park-Fly	+1.3%	+11.0%	-4.0%
Remote on A/P	NA	NA	NA
2. VEHICLE TRIPS			
AUTO ACCOMP	-7.0%	+3.1%	-3.0%
AUTO UNACCOMP	+0.8%	-8.9%	-4.7%
TOTAL	-2.6%	+0.5%	-3.0%
3. HIGHWAY VMT	-2.6%	+0.7%	-1.8%
4. VEHICLES PARKING AT LOGAN			
GARAGE PARKING	-36.8%	-3.5%	-3.7%
METER PARKING	-75.4%	+2.9%	-2.9%
TOTAL ON A/P	-43.4%	-2.4%	-3.5%
CURB PARKING	+45.9%	+3.5%	-3.2%
5. CONSUMER SURPLUS (CHANGE)			
Dollars	-$188,624	-$66,541	+$63,202
Time	-1,090 hrs.	-567 hrs.	+517 hrs.
6. MASSPORT REVENUES			
Total	-$1,371/day -2.7%	+$5,467/day +10.7%	-$1,614/day -3.9%
Bus	+6.0%	+1.6%	-2.2%
Meter	-53.9%	+3.0%	-2.9%
Garage	-1.6%	+11.0%	-4.0%

decreased by 0.8 percent; auto unaccompanied increased by 2.5 percent with garage parking for this mode decreasing by 3.3 percent. Overall garage parking (short-term plus long-term) decreased by 1.5 percent, meter parking by 0.6 percent, and curb dropoff by 0.8 percent. Highway VMT showed no appreciable change. Consumer surplus showed a small increase (+$16,966 or +151 hours saved). Massport revenues showed a 1.9 percent increase ($787 per day). Park/fly lot parkers decreased by 5.5 percent and park/fly lot revenues by 4 percent (Note: since the model is not really able to distinguish the existing park/fly lots from the new on-airport remote lots in terms of cost and level of service, it splits all remote lot users equally between the two. As a result, some aspects of this alternative's results must be taken advisedly. If costs and/or shuttle service were different, model results would be more well-founded, but overall, advertising and accessibility would play a larger role in distinguishing among specific park/fly facilities.)

Alternative 4 and 5 simulate the effect of constraining the parking supply at Logan for short-term parkers and long-term parkers respectively. The parking constraint forecasts are done in each case by using successive parking price increases to reduce parking demand (peak occupancy) until th desired level of parking is reached (in this case, that mandated by the Boston TCP).

The current interpretation of the TCP is to limit public meter and garage parking at Logan to 9065 spaces. However, the base case shows Apri 1981 peak occupancy to be only 7915. Therefore, for the sake of this analysis, the overall level of air passenger travel and all attendant groud

travel have been scaled up by an arbitrary 25 percent to generate an initial peak parking occupancy of 9893, an excess of 828 vehicles (9 percent) over the TCP limit. For Alternatives 4 and 5 then, the base case is 1.25 times each of the appropriate figures in the previous base case depicted in Table 2.

Alternative 4 represents the effect of constraining short-term parking until total parking demand falls within the acceptable level. The forecasting model accomplishes this by raising the short-term parking price iteratively (without changing the long-term parking price) and carrying out forecasts at each price level until the resulting demand for parking is reduced to 9065 spaces. The ultimate price which caused the "constraint" to be met is called a <u>shadow price</u> and it has some conceptual meaning. In Alternative 4 a short-term parking price of $1.88 per hour (vs. $1.00 per hour in the base case) was necessary to suitably reduce parking levels. This means that the last short-term parker would be willing to pay $1.88 per hour for that last parking space.

In Alternative 5, a long-term parking price increase to $8.03 per day (vs. $6.00 per day in the base case) was necessary to accomplish the desired parking reduction.

These two alternatives are perhaps the most interesting of the alternatives analyzed because of the contrasts in impacts. <u>Alternative 4</u> shows a 3.5 percent - 5.5 percent increase in public transit usage versus an increase of about half that much for <u>Alternative 5</u>. Alternative 4 produces a very significant 2.6 percent <u>reduction</u> in highway VMT whereas the long-term parking price penalty of Alternative 5 produces an <u>increase</u> of 0.7 percent in VMT because of shifts to the auto accompanied mode.

Neither of Alternatives 4 or 5 is attractive to travellers in a consumers' surplus sense, as is to be expected. Alternative 4 (-$188,624 or -1090 hours) was even less desirable than Alternative 5 (-$66,541 or -567 hours) in this regard. Likewise Alternative 4 was even less desirable with respect to Massport revenues. Massport revenues were down 2.7 percent in Alternative 4 but up 10.7 percent in Alternative 5. (In the base case, of all Massport parking revenues, over 90 percent comes from long-term parkers)

Alternative 4 produces some major consequences in terms of the redistribution of auto access modes. Auto accompanied decreases by 7 percent overall. Garage parking is reduced by 37 percent and meter parking by 75 percent (a 43 percent overall reduction in on-airport parking), but curb side pickup and dropoff increases by 46 percent, probably an intolerable amount. In contrast, Alternative 5 has much less radical results. It show an 8.9 percent decrease in auto unaccompanied and a 3.1 percent increase in auto accompanied. Garage parking is reduced by 3.5 percent and meter parking increases by 2.9 percent. Curbside parking demand increases by an acceptable 3.5 percent.

Alternative 6 demonstrates the effects of improving express bus and limousine service to Logan. This is essentially a proposal to reduce parking at Logan. It was designed by John Martin and Peter Sheinfeld of Massport. This alternative includes new bus and limo routes, connecting Logan with existing MBTA express bus service from the North Shore, and Massport shuttle bus service to the North Apron and Orient Heights. This alternative is more extensively specified in John Martin's memo of July 11, 1980, included here as Appendix B. It has also been annotated to define the

new express bus and limo stops which the forecasting model uses to present number of passengers (and companions) by stop, a special output shown for the Base Case and for Alternative 6 only.

This alternative is really designed more for airport employees than for passengers. Consequently it doesn't have dramatic effects on passenger access. The improved service specified does produce a 28.8 percent increase in the XBUS/LIMO mode, but it reduces MBTA Blue Line ridership by 2.3 percent and taxi usage by 1.9 percent. Auto accompanied is reduced by 2.8 percent (spread evenly over curb, meter, and garage) and auto unaccompanied decreases by 4.4 percent. Overall on-airport parking is reduced by 3.5 percent. Highway VMT is reduced by 1.8 percent.

Massport revenues (excluding new shuttle bus operations) decrease by 3.9 percent ($1,614 per day). Express bus and limo revenues (from air travellers only) are increased by 40.4 percent ($11,133 per day), but this must of course be balanced against the costs associated with the increased bus/limo operations. A few of the new bus/limo stops can attract more than 200 passengers per day (Manchester NH (270), Providence (235), Downtown Boston hotels (614), and Lexington (242)). Several others are in the 100-200 passenger per day range (Medford, Concord, Walpole, Derry NH, Burlington, Newton, and Worcester).

APPENDIX A

DETAILED RESULTS OF THE BASE CASE AND THE SIX LOGAN AIRPORT ACCESS ALTERNATIVES ANALYZED

BASE CASE (APRIL 1981)

K PERSON-TRIPS

MODE

EG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
.C	602	819	1795	308	2944	5340	11808
IN	498	786	2644	2746	993	0	7667
.C	557	896	764	47	5402	1307	8973
IN	557	504	1446	949	1784	0	5240
l	2215	3005	6648	4051	11123	6647	33689
	6.6	8.9	19.7	12.0	33.0	19.7	

L CAR

IG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
C	12	40	255	308
N	106	356	2285	2746
C	2	6	40	47
N	56	148	745	949
	177	549	3325	4051

ARK

G	PARK_TYPE CURB	METER	GARAGE	TOTAL
C	1962	296	686	2944
N	584	115	295	993
C	2811	655	1936	5402
N	780	323	681	1784
	6137	1389	3597	11124

ARK

G	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
C	5033	308	5341
N	0	0	0
C	1194	113	1307
N	0	0	0
	6227	421	6647

VEHICLE TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	0	0	1415	231	4581	4080	10[illegible]7
BUSNON	0	0	1995	2184	1671	0	5[illegible]0
PLALOC	0	0	489	35	6598	763	7[illegible]5
PLANON	0	0	918	676	2608	0	4[illegible]2
TOTAL	0	0	4817	3127	15458	4843	28[illegible]4

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1042)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	30	192	231
BUSNON	84	283	1817	2183
PLALOC	2	4	29	35
PLANON	39	103	534	676
TOTAL	134	420	2572	3127

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	3064	464	1053	4581
BUSNON	988	191	492	1671
PLALOC	3357	819	2423	6599
PLANON	1161	473	974	2608
TOTAL	8570	1946	4942	15459

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	3889	191	4080
BUSNON	0	0	0
PLALOC	711	52	763
PLANON	0	0	0
TOTAL	4600	243	4843

MDE

	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
C	0	18	132	0	6789	0	6940
N	26	49	71	206	2068	0	2420
C	26	168	60	21	10512	0	10787
N	257	38	130	129	4346	0	4901
	309	273	393	356	23715	0	25047

L CAR

	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
	0	0	0	0
	8	27	171	206
	1	2	18	21
	8	20	101	129
	17	49	290	356

RK

	PARK_TYPE CURB	METER	GARAGE	TOTAL
	4214	545	2029	6789
	1100	302	666	2068
	4369	1597	4546	10512
	1630	847	1869	4346
	11313	3291	9111	23715

AIRPAX CONSUMER SURPLUS

BASE CASE

MKTSEG	DOLLARS	MINUTES
BUSLOC	-711777	-498123
BUSNON	-67967	-198218
PLALOC	459552	140218
PLANON	-179650	-64013
TOTAL	-499843	-620136

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	0	0	23791	13545	142692	143314	3234[illegible]
BUSNON	0	0	15695	104644	71176	0	1911[illegible]
PLALOC	0	0	11968	1543	240066	40456	2943[illegible]
PLANON	0	0	15207	41727	107550	0	1648[illegible]
TOTAL	0	0	66662	161459	561484	183770	973[illegible]

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 26579)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	751	7514	36513	6702	7642	53977	11[illegible]
BUSNON	475	5521	24490	61663	3941	0	9[illegible]
PLALOC	1005	8685	18313	743	12737	13996	5[illegible]
PLANON	713	3422	23075	20277	5712	0	5[illegible]
TOTAL	2944	25142	102390	89385	30032	67974	31[illegible]

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BUSLOC	40038	67929	76158	35185	157913	328356	7058[illegible]
BUSNON	23736	51839	74966	264951	62822	0	4731[illegible]
PLALOC	50728	84166	41262	4562	333350	112707	6277[illegible]
PLANON	38441	30837	54935	112341	117052	0	3560[illegible]
TOTAL	152944	234771	247322	417039	671137	441064	21627[illegible]

EUES (DOLLARS) BASE CASE

SG	MBTA	MPA_BUS	XBUS	TAXI
_C	601	151	7682	37860
NN	368	131	5862	24818
_C	907	146	10315	19029
NN	839	203	3680	24116
A	2714	631	27539	105823

KNG REVENUES (DOLLARS)

EG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
LIC	232	527	27531	1267
NN	95	246	0	0
LIC	409	1211	9263	671
NN	236	487	0	0
A.	973	2471	36794	1938

PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
SEGS	276	702	6937	7915

BUS-LIMO AIRPAX & COMPANIONS

BASE CASE

STOP	PAX+COMP
3	153
6	52
7	12
8	18
10	176
11	31
12	31
13	24
14	18
15	22
16	71
17	41
18	72
19	46
21	231
25	87
27	26
28	161
29	52
30	22
31	38
32	50
33	52
41	5
45	80
46	4
47	3
49	17
52	4
53	8
55	24
56	3
61	99
62	21
64	2
65	19
66	31
67	2
68	270
70	13
71	17
73	48
75	41
76	108
77	235
78	11
79	11
81	7
82	8
83	2
86	8
87	26
89	44
99	619

Σ = 3276

ALTERNATIVE 1

Long-Term Parking at $4.50/Day

SUMMARIES

ALTERNATIVE 1

Long-Term Parking at $4.50/Day

X PERSON-TRIPS

MODE

G	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
LC	579	770	1718	289	2787	5666	11808
NN	498	786	2644	2747	994	0	7667
LC	542	868	741	46	5231	1546	8973
NN	557	504	1446	949	1785	0	5240
A	2175	2928	6549	4030	10795	7212	33689

TL CAR

SG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
LC	12	38	239	289
NN	106	356	2285	2747
LC	2	5	39	46
NN	56	148	745	949
A	176	547	3307	4030

ARK

EG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LC	1856	280	650	2786
NN	584	115	295	993
LC	2718	633	1880	5231
NN	780	323	681	1784
L	5939	1351	3505	10795

ARK

EG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
DC	5371	295	5666
DN	0	0	0
DC	1449	97	1546
DN	0	0	0
L	6820	392	7212

VEHICLE TRIPS

ALTERNATIVE 1

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOT
BUSLOC	0	0	1358	217	4339	4325	102[illegible]
BUSNON	0	0	1995	2184	1671	0	58[illegible]
PLALOC	0	0	475	34	6385	908	78[illegible]
PLANON	0	0	918	677	2608	0	42[illegible]
TOTAL	0	0	4746	3111	15004	5234	2804

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	28	180	217
BUSNON	84	283	1817	2184
PLALOC	2	4	28	34
PLANON	39	103	534	677
TOTAL	133	418	2560	3111

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	2901	440	998	4339
BUSNON	988	191	492	1671
PLALOC	3243	791	2353	6386
PLANON	1161	473	974	2608
TOTAL	8293	1894	4817	15004

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	4142	183	4326
BUSNON	0	0	0
PLALOC	864	44	908
PLANON	0	0	0
TOTAL	5006	228	5234

NION PERSON-TRIPS

ALTERNATIVE 1

MODE

G	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
C	0	17	127	0	6426	0	6570
N	26	49	71	206	2068	0	2420
C	26	163	58	20	10181	0	10448
N	257	38	130	129	4347	0	4901
A	308	267	386	355	23023	0	24339

L CAR

G	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
JC	0	0	0	0
N	8	27	171	206
JC	1	2	17	20
N	8	20	101	129
A	17	49	290	355

ARK

G	PARK_TYPE CURB	METER	GARAGE	TOTAL
IC	3987	516	1923	6426
N	1100	302	666	2068
IC	4225	1543	4414	10181
N	1630	847	1870	4347
L	10942	3208	8873	23023

ALTERNATIVE 1

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-6.91246E+05	-4.83658E+05
BUSNON	-6.79713E+04	-1.98233E+05
PLALOC	+4.90643E+05	+1.52032E+05
PLANON	-1.79678E+05	-6.40224E+04
TOTAL	-4.48251E+05	-5.93881E+05

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTA
BUSLOC	0	0	22515	12496	133839	151964	32081
BUSNON	0	0	15696	104651	71185	0	1915
PLALOC	0	0	11553	1410	230654	46719	2903
PLANON	0	0	15209	41731	107574	0	16451
TOTAL	0	0	64973	160287	543252	198683	9671

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTA
BUSLOC	717	7050	34552	6233	7174	49045	1047
BUSNON	480	5522	24491	61567	3941	0	961
PLALOC	970	8396	17677	695	12248	14150	541
PLANON	738	3422	23077	20279	5713	0	532
TOTAL	2905	24391	99797	88873	29076	63195	3082

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOT
BUSLOC	38195	63661	72307	32679	148421	347799	7030
BUSNON	23679	51845	74968	264968	62831	0	4782
PLALOC	49198	81349	39914	4243	320986	129662	6253
PLANON	38382	30842	54937	112348	117070	0	3535
TOTAL	149453	227696	242125	414238	649308	477461	21602

NUES (DOLLARS)

EG	MBTA	MPA_BUS	XBUS	TAXI
OC	572	145	7208	35827
ON	374	131	5863	24819
OC	874	142	9971	18368
ON	875	203	3680	24118
L	2695	621	26723	103132

ING REVENUES (DOLLARS)

TEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
OC	220	499	23159	1201
ON	95	246	0	0
OC	395	1176	8944	505
ON	236	487	0	0
L	947	2409	32103	1707

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ALTERNATIVE 2

Long-Term Parking at $9.00/Day

Short-Term Parking at $1.50/Hour

ALTERNATIVE 2

Long-Term Parking at $9.00/Day
Short-Term Parking at $1.50/Hour

\ST SUMMARIES

:PAX PERSON-TRIPS

:N MODE

'SEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
;LOC	643	905	1929	341	3211	4779	11809
;NON	503	796	2664	2780	924	0	7667
.LOC	609	988	838	53	5424	1062	8973
.NON	603	555	1543	1044	1495	0	5240
:AL	2359	3244	6974	4218	11053	5841	33689

:ITAL CAR

'SEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
;LOC	14	45	283	341
;NON	107	360	2313	2780
.LOC	2	6	44	53
.NON	63	163	819	1044
:AL	186	574	3458	4218

/ PARK

KSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
ULOC	2676	159	376	3211
UNON	661	74	189	924
LLOC	4302	228	894	5424
LNON	916	184	394	1495
:AL	8554	646	1854	11054

/ PARK

KSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
ULOC	4449	331	4779
UNON	0	0	0
LLOC	894	168	1062
LNON	0	0	0
:AL	5342	499	5841

VEHICLE TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	0	0	1516	257	4995	3653	10
BUSNON	0	0	2011	2212	1557	0	5
PLALOC	0	0	536	39	6624	612	7
PLANON	0	0	962	744	2195	0	3
TOTAL	0	0	5045	3252	15371	4264	27

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	10	33	213	257
BUSNON	85	287	1840	2212
PLALOC	2	5	33	39
PLANON	44	114	587	744
TOTAL	141	438	2673	3252

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	4168	249	579	4996
BUSNON	1119	123	315	1557
PLALOC	5202	289	1132	6624
PLANON	1361	269	564	2195
TOTAL	11851	931	2591	15372

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	3449	204	3653
BUSNON	0	0	0
PLALOC	532	79	612
PLANON	0	0	0
TOTAL	3981	283	4264

AI MODE

TSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
JE.OC	0	20	142	0	7153	0	7316
JENON	26	49	71	209	1867	0	2222
L.LOC	29	185	66	23	9341	0	9644
LNON	278	42	139	142	3480	0	4081
TAL	333	297	418	374	21841	0	23263

ITAL CAR

SEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
J_LOC	0	0	0	0
JNON	8	27	173	208
LLOC	1	3	19	23
LNON	9	22	111	142
AL	18	52	304	374

PARK

SEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LLOC	5746	293	1114	7153
NON	1245	195	427	1867
LLOC	6686	556	2100	9341
LNON	1913	483	1083	3480
AL	15591	1527	4724	21841

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-7.46308E+05	-5.21854E+05
BUSNON	-6.92564E+04	-2.01609E+05
PLALOC	+3.68085E+05	+1.04715E+05
PLANON	-2.36670E+05	-7.77077E+04
TOTAL	-6.84149E+05	-6.96456E+05

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	0	0	26121	15406	157838	128295	327
BUSNON	0	0	15865	106102	67310	0	189
PLALOC	0	0	13295	1825	242500	34094	291
PLANON	0	0	16880	46062	91588	0	154
TOTAL	0	0	72161	169395	559237	162389	963

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	812	8319	40092	7539	8343	60468	12
BUSNON	486	5601	24754	62491	3728	0	9
PLALOC	1101	9562	20344	856	12585	13924	53
PLANON	811	3830	25619	22304	4865	0	54
TOTAL	3211	27332	110810	93189	29521	74393	334

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	43316	75252	83073	39604	174110	294654	710
BUSNON	24001	52595	75601	268251	59063	0	475
PLALOC	55791	92875	45570	5282	336429	95510	634
PLANON	42142	34570	59944	123756	98795	0	352
TOTAL	165249	255292	264188	436892	668397	390164	2181

ENUES (DOLLARS)

SEG	MBTA	MPA_BUS	XBUS	TAXI
LOC	651	161	8506	41572
NON	379	132	5947	25086
LOC	993	160	11379	21140
NON	965	220	4119	26775
AL	2989	673	29950	114572

KING REVENUES (DOLLARS)

SEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
LOC	187	434	33615	1381
NON	92	237	0	0
LOC	217	849	9298	1215
NON	202	423	0	0
AL	698	1943	42912	2596

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CAMBRIDGE SYSTEM

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AOS XLPT REV

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ALTERNATIVE 3

On-Airport Remote Parking

CAT SUMMARIES

ALTERNATIVE 3

On-Airport Remote Parking

IPAX PERSON-TRIPS

AN MODE

KSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
ULOC	593	802	1759	301	2888	5466	11808
UNON	498	786	2644	2747	993	0	7667
LLOC	555	892	759	47	5371	1349	8973
LNON	557	504	1446	949	1785	0	5240
TAL	2202	2983	6609	4043	11037	6816	33689

ENTAL CAR

KSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
ULOC	12	39	249	301
UNON	106	356	2285	2747
LLOC	2	6	39	47
LNON	56	148	745	949
TAL	176	548	3319	4043

/ PARK

KSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LLOC	1923	290	674	2887
UNON	584	115	295	993
LLOC	2793	651	1928	5372
LNON	780	323	681	1784
TAL	6080	1379	3578	11037

/ PARK

KSEG	PARK_TYPE ON-A/P	PARK/FLY	REMOTE	TOTAL
ULOC	4881	293	293	5467
UNON	0	0	0	0
LLOC	1139	105	105	1349
LNON	0	0	0	0
TAL	6020	398	398	6816

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	0	0	1392	227	4506	4163	10
BUSNON	0	0	1995	2184	1671	0	5
PLALOC	0	0	487	35	6568	783	7
PLANON	0	0	918	677	2608	0	4
TOTAL	0	0	4792	3122	15353	4946	28

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	29	188	227
BUSNON	84	283	1817	2184
PLALOC	2	4	29	35
PLANON	39	103	534	677
TOTAL	134	419	2568	3122

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	3012	456	1038	4506
BUSNON	988	191	492	1671
PLALOC	3340	815	2414	6569
PLANON	1161	473	974	2608
TOTAL	8501	1934	4918	15354

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	REMOTE	TOTAL
BUSLOC	3793	185	185	4163
BUSNON	0	0	0	0
PLALOC	685	49	49	783
PLANON	0	0	0	0
TOTAL	4477	234	234	4946

\N MODE

:SEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
JLOC	0	18	130	0	6660	0	6808
JNON	26	49	71	206	2068	0	2420
-LOC	26	167	59	21	10454	0	10727
-NON	257	38	130	129	4347	0	4901
)AL	309	272	391	356	23529	0	24856

:TAL CAR

:SEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
JLOC	0	0	0	0
JNON	8	27	171	206
-LOC	1	2	18	21
-NON	8	20	101	129
)AL	17	49	290	356

/ PARK

:SEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
JLOC	4130	534	1996	6660
JNON	1100	302	666	2068
-LOC	4341	1587	4526	10454
-NON	1630	847	1870	4347
)AL	11201	3270	9058	23529

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-7.01009E+05	-4.91160E+05
BUSNON	-6.79712E+04	-1.98233E+05
PLALOC	4.65780E+05	1.42357E+05
PLANON	-1.79678E+05	-6.40225E+04
TOTAL	-4.82877E+05	-6.11059E+05

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOT
BUSLOC	0	0	23283	13234	140111	146000	3226
BUSNON	0	0	15696	104651	71185	0	1915
PLALOC	0	0	11906	1521	238751	41323	2935
PLANON	0	0	15209	41731	107574	0	1645
TOTAL	0	0	66094	161136	557621	187323	9721

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOT
BUSLOC	738	7351	35731	6554	7506	55169	1130
BUSNON	480	5522	24491	61567	3941	0	961
PLALOC	1000	8636	18217	736	12670	14252	555
PLANON	738	3422	23077	20279	5713	0	532
TOTAL	2956	24931	101516	89234	29830	69421	317

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	39336	66459	74407	34326	154644	335437	704
BUSNON	23679	51845	74968	264968	62831	0	478
PLALOC	50471	83696	41011	4507	331187	115665	626
PLANON	38382	30842	54937	112348	117070	0	353
TOTAL	151867	232843	245322	416149	665731	451102	2163

NUES (DOLLARS)

BEG	MBTA	MPA_BUS	XBUS	TAXI
E.OC	590	148	7516	37049
EION	374	131	5863	24819
A.OC	902	145	10256	18930
AION	875	203	3680	24118
TAL	2741	628	27315	104916

KING REVENUES (DOLLARS)

BEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY	AUREMOTE
E.OC	228	519	26898	1232	1232
EION	95	246	0	0	0
A.OC	407	1207	8843	629	629
AION	236	487	0	0	0
TAL	967	2459	35741	1861	1861

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ALTERNATIVE 4

Short-Term Parking Constraint

AT SUMMARIES

ALTERNATIVE 4

Short-Term Parking Constraint

RAX PERSON-TRIPS

I MODE

TEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
BOC	753	1024	2242	384	3683	6674	14760
BON	633	1002	3342	3496	1112	0	9584
AOC	749	1211	1028	64	6446	1719	11216
AON	781	726	1987	1363	1693	0	6550
TL	2916	3962	8600	5307	12934	8393	42111

NAL CAR

TEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BOC	15	50	319	385
BON	134	453	2908	3495
AOC	3	8	54	64
AON	82	213	1067	1363
TL	235	724	4348	5307

PARK

TEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LOC	3349	92	237	3683
NON	883	65	164	1112
LOC	5838	99	509	6446
NON	1237	144	312	1693
AL	11307	406	1221	12934

PARK

SEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
LOC	6289	384	6674
NON	0	0	0
LOC	1570	149	1719
NON	0	0	0
AL	7860	533	8393

VEHICLE TRIPS

ALTERNATIVE 4

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	0	0	1768	289	5732	5098	12
BUSNON	0	0	2524	2782	1876	0	7
PLALOC	0	0	657	48	7861	1004	9
PLANON	0	0	1266	972	2493	0	4
TOTAL	0	0	6215	4090	17962	6102	34

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1372)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	11	37	240	289
BUSNON	107	361	2314	2782
PLALOC	2	6	40	48
PLANON	57	149	765	972
TOTAL	178	552	3360	4090

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	5215	154	364	5732
BUSNON	1495	107	272	1876
PLALOC	7078	126	657	7861
PLANON	1837	211	446	2493
TOTAL	15625	598	1740	17962

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	4859	238	5098
BUSNON	0	0	0
PLALOC	935	69	1004
PLANON	0	0	0
TOTAL	5795	307	6102

ALTERNATIVE 4

?NION PERSON-TRIPS

MODE

?G	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
LC	0	23	165	0	8073	0	8261
NN	33	62	90	262	2204	0	2651
LC	35	227	80	29	10509	0	10880
NN	360	55	179	185	3818	0	4597
AI	429	367	515	476	24604	0	26390

TL CAR

SG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
LC	0	0	0	0
NN	10	34	218	262
LC	1	3	24	29
NN	11	29	145	185
A	23	66	387	476

ARK

SG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LC	7192	181	700	8073
NN	1664	170	370	2204
LIC	9073	242	1194	10509
NN	2584	378	857	3818
A.	20513	970	3121	24604

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-889572	-622535
BUSNON	-87352	-254040
PLALOC	491132	140799
PLANON	-327621	-104829
TOTAL	-813413	-840605

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	0	0	29729	16925	178545	179103
BUSNON	0	0	19936	133515	81723	0
PLALOC	0	0	16222	2082	285173	52812
PLANON	0	0	22138	60197	104569	0
TOTAL	0	0	88025	212718	650010	231915

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 35357)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	938	9389	45626	8374	9335	67456
BUSNON	605	7049	31106	78617	4505	0
PLALOC	1356	11736	24522	1002	14548	18490
PLANON	1022	5043	33605	29099	5505	0
TOTAL	3921	33217	135159	117092	33893	85946

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U
BUSLOC	50023	84858	95159	43964	197574	410366
BUSNON	30279	66205	94946	337323	71486	0
PLALOC	68399	113794	55629	6147	397030	147040
PLANON	55067	45563	78014	161606	112223	0
TOTAL	203768	310420	323748	549040	778314	557406

.NUES (DOLLARS)

?EG	MBTA	MPA_BUS	XBUS	TAXI
E.OC	750	188	9593	47309
EION	470	167	7485	31523
A.OC	1224	196	13938	25792
AION	1207	285	5424	35120
?L	3652	836	36445	139745

RING REVENUES (DOLLARS)

?EG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
E.OC	144	342	34402	1583
EION	101	257	0	0
A.OC	119	617	12284	899
AION	198	418	0	0
?L	561	1633	46686	2483

A PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
L SEGS	85	247	8738	9070

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CAMBRIDGE SYSTEM

AOS REV 0
AOS XLPT RE

ALTERNATIVE 5

Long-Term Parking Constraint

ALTERNATIVE 5

UMMARIES

Long-Term Parking Constraint

XPERSON-TRIPS

MDE

G	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
C	789	1099	2360	414	3913	6186	14760
N	623	982	3304	3433	1242	0	9584
C	714	1153	980	61	6944	1364	11216
N	696	629	1808	1186	2230	0	6550
	2822	3863	8453	5094	14329	7549	42111

LCAR

G	RENT_TYPE OFF-A/P	ON-A/P	BIGG	TOTAL
C	17	54	343	414
N	132	445	2856	3433
C	3	7	51	61
N	71	184	931	1186
	222	691	4181	5094

AK

G	PARK_TYPE CURB	METER	GARAGE	TOTAL
C	2611	394	908	3913
N	730	144	368	1242
C	3623	845	2477	6945
N	976	404	851	2230
	7939	1767	4604	14330

AK

G	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
C	5781	405	6186
N	0	0	0
C	1184	180	1364
N	0	0	0
	6965	584	7549

VEHICLE TRIPS

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	0	0	1857	311	6086	4727	12
BUSNON	0	0	2494	2729	2089	0	7
PLALOC	0	0	628	46	8487	789	9
PLANON	0	0	1147	846	3260	0	5
TOTAL	0	0	6125	3932	19922	5516	35

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 1343)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	12	40	259	311
BUSNON	105	354	2271	2729
PLALOC	2	5	38	46
PLANON	49	129	668	846
TOTAL	169	528	3205	3932

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	4075	616	1396	6087
BUSNON	1235	238	615	2089
PLALOC	4332	1058	3099	8488
PLANON	1451	591	1218	3260
TOTAL	11093	2503	6327	19924

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	4478	250	4728
BUSNON	0	0	0
PLALOC	705	84	789
PLANON	0	0	0
TOTAL	5183	334	5517

AION PERSON-TRIPS

MODE

SEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
LC	0	25	174	0	9020	0	9219
NN	33	61	89	257	2585	0	3024
LC	34	216	77	27	13507	0	13860
NN	321	47	163	161	5433	0	6126
AL	387	349	502	446	30545	0	32230

L CAR

SEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
LC	0	0	0	0
NN	10	33	214	257
LC	1	3	23	27
NN	10	25	127	161
AL	21	62	364	446

ARK

SEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
LC	5607	725	2688	9020
NN	1375	377	833	2585
LC	5631	2062	5814	13507
NN	2038	1058	2337	5433
A	14651	4222	11672	30545

AIRPAX CONSUMER SURPLUS

MKTSEG	DOLLARS	MINUTES
BUSLOC	-920053	-643618
BUSNON	-84960	-247768
PLALOC	538240	162168
PLANON	-224557	-80017
TOTAL	-691330	-809234

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	0	0	31756	18549	191555	166073	407
BUSNON	0	0	19620	130808	88961	0	239
PLALOC	0	0	15446	2110	310864	43439	371
PLANON	0	0	19010	52159	134437	0	205
TOTAL	0	0	85831	203625	725816	209512	1224

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 34387)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TO
BUSLOC	991	10096	43740	9104	10251	73484	15
BUSNON	593	6901	30612	77080	4926	0	12
PLALOC	1292	11175	23634	993	16479	16942	7
PLANON	892	4277	29944	25347	7140	0	6
TOTAL	3768	32450	[illegible]	112524	38796	90426	407

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TT
BUSLOC	52877	91313	101189	47827	211510	381108	888
BUSNON	29670	64799	93702	331196	78522	0	598
PLALOC	65158	108302	53144	6129	430821	121537	780
PLANON	48051	38547	68668	140427	146314	0	440
TOTAL	195757	302961	316703	525578	867167	502645	2718

EUES (DOLLARS)

SIG	MBTA	MPA_BUS	XBUS	TAXI
LC	794	197	10322	50538
NN	460	164	7328	31023
LC	1165	187	13272	24558
NN	1048	254	4600	30145
A	3468	802	35522	136265

KNG REVENUES (DOLLARS)

SG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
LIC	308	698	39971	1684
NN	119	308	0	0
LIC	529	1549	11365	1228
NN	295	609	0	0
A	1252	3164	51336	2912

PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
SEGS	355	898	[illegible]	9170

ALTERNATIVE 6

Improved Bus/Limo

T SUMMARIES

ALTERNATIVE 6

IMPROVED BUS/LIMO

AX PERSON-TRIPS

MODE

EG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
DC	581	1296	1722	297	2830	5082	11809
DN	494	871	2627	2705	971	0	7667
DC	540	1120	742	46	5257	1271	8977
DN	548	582	1433	939	1754	0	5257
L	2163	3869	6524	3988	10813	6353	33710

AL CAR

EG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
OC	12	39	246	297
ON	104	351	2250	2705
DC	2	5	39	46
ON	56	146	738	939
L	174	541	3273	3988

PARK

EG	PARK_TYPE CURB	METER	GARAGE	TOTAL
OC	1883	285	662	2830
ON	572	112	287	971
OC	2735	638	1885	5258
ON	767	317	669	1754
L	5957	1352	3504	10813

UPARK

TEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
SOC	4788	294	5082
SON	0	0	0
AOC	1161	110	1271
AON	0	0	0
TL	5949	404	6353

MAIN MODE

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	T
BUSLOC	0	0	1354	223	4392	3876	
BUSNON	0	0	1981	2147	1630	0	
PLALOC	0	0	475	34	6413	741	
PLANON	0	0	907	668	2560	0	
TOTAL	0	0	4717	3072	14995	4616	2

(DEAD-HEAD NON-BOSTON TAXI TRIPS NOT INCL. ABOVE= 994)

RENTAL CAR

MKTSEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
BUSLOC	9	29	185	223
BUSNON	82	278	1786	2147
PLALOC	2	4	29	34
PLANON	39	101	527	668
TOTAL	132	413	2527	3072

A/A PARK

MKTSEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
BUSLOC	2932	446	1015	4392
BUSNON	967	185	478	1630
PLALOC	3261	796	2358	6414
PLANON	1140	463	956	2559
TOTAL	8299	1890	4807	14995

A/U PARK

MKTSEG	PARK_TYPE ON-A/P	PARK/FLY	TOTAL
BUSLOC	3694	181	3876
BUSNON	0	0	0
PLALOC	690	51	741
PLANON	0	0	0
TOTAL	4384	232	4616

MANION PERSON-TRIPS

ALTERNATIVE 6

I MODE

TEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	TOTAL
SOC	0	29	127	0	6529	0	6685
SON	26	54	70	203	2020	0	2373
AOC	25	210	58	21	10232	0	10546
AON	253	44	129	128	4273	0	4826
TL	304	337	385	351	23054	0	24431

AL CAR

TEG	RENT_TYPE OFF-A/P	ON-A/P	BIG3	TOTAL
SOC	0	0	0	0
SION	8	26	169	203
AOC	1	2	17	21
AION	8	20	100	128
TL	16	49	286	351

PARK

TEG	PARK_TYPE CURB	METER	GARAGE	TOTAL
SOC	4044	525	1959	6529
SION	1077	294	649	2020
AOC	4250	1556	4426	10232
AION	1603	831	1839	4273
AL	10974	3206	8873	23054

AIRPAX CONSUMER SURPLUS

ALTERNATIVE 6

MKTSEG	DOLLARS	MINUTES
BUSLOC	-689890	-484349
BUSNON	-66451	-194412
PLALOC	487775	150902
PLANON	-168075	-61273
TOTAL	-436641	-589131

HIGHWAY VMT

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	T[illegible]
BUSLOC	0	0	22537	13351	138578	138784	31[illegible]
BUSNON	0	0	15434	103944	70428	0	18[illegible]
PLALOC	0	0	11722	1525	236772	39998	29[illegible]
PLANON	0	0	15002	41546	106590	0	16[illegible]
TOTAL	0	0	64695	160365	552367	178782	95[illegible]

(DEAD-HEAD NON-BOSTON TAXI VMT NOT INCL. ABOVE= 25628)

AGGREGATE AIRPAX COST (DOLLARS)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	T[illegible]
BUSLOC	718	13190	34577	6512	7408	51798	11[illegible]
BUSNON	468	6664	24079	60909	3896	0	9[illegible]
PLALOC	977	11276	17936	726	12542	13692	51[illegible]
PLANON	700	4389	22761	20099	5655	0	5[illegible]
TOTAL	2863	35518	99353	88247	29502	65490	32[illegible]

AGGREGATE AIRPAX TIME (MINUTES)

MKTSEG	MAIN_MODE MBTA	XBUS	TAXI	RENT	A/A	A/U	T[illegible]
BUSLOC	38013	81661	72508	34434	152850	315867	69[illegible]
BUSNON	23369	53577	74160	262064	61907	0	47[illegible]
PLALOC	49184	89515	40342	4483	327742	111201	62[illegible]
PLANON	37717	32772	54322	111685	115785	0	35[illegible]
TOTAL	148283	257526	241331	412666	658285	427069	214[illegible]

ENUES (DOLLARS)

SEG	MBTA	MPA_BUS	XBUS	TAXI
LOC	572	145	13485	35853
NON	363	130	7076	24402
LOC	882	141	13391	18637
NON	822	200	4720	23787
AL	2639	617	38672	102679

KING REVENUES (DOLLARS)

SEG	AA_METER	AA_GRAGE	AU_ON-AP	AU_PRFLY
LOC	223	507	26265	1211
NON	93	239	0	0
LOC	398	1179	9024	655
NON	232	478	0	0
AL	945	2403	35289	1866

EK PARKING OCCUPANCY

	AA_METER	AA_GRAGE	AU_ON-AP	TOTAL
SEGS	268	683	6611	7562

STOP	PAX+COMP
3	153
6	52
7	12
8	15
10	124
11	8
12	31
13	24
14	18
15	9
16	61
17	8
18	69
19	28
21	126
25	72
27	26
28	161
29	52
30	8
31	33
33	42
41	5
45	80
46	4
47	3
49	17
52	4
53	8
55	24
56	3
61	99
62	21
64	2
65	19
66	31
67	2
68	270
70	13
71	17
73	48
75	41
76	39
77	235
78	11
79	11
81	7
82	8
83	2
86	8
87	26
89	37
99	614
101	25
102	33
103	60

ALTERNATIVE 6

(4	28
(5	105
(6	81
(7	242
(8	143
0	79
1	74
2	141
3	73
4	74
5	92
6	111

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CAMBRIDGE SYSTEM

AOS REV 03

AOS XLPT REV

APPENDIX B

JOHN MARTIN MEMO DEFINING NEW BUS/LIMO SERVICE ALTERNATIVE

MASSACHUSETTS PORT AUTHORITY

T. Baldwin
P. Sheinfeld
N. Faranelli
J. Brevard
J. MacMann
H. Conover

SEE PAGE 4 ff FOR DEFINITION OF NEW XBUS/LIMO STOPS

John Martin

July 11, 1980

Proposals for CSI Modeling

A number of alternatives for reducing employee and passenger parking at the port have been identified. The alternatives include new bus and limo routes, connections with existing MBTA express bus service from the North Shore, Massport shuttle bus service to the north apron and Orient Heights, carpooling, and free discounted fare on the MBTA and on the shuttle bus. Most of these proposals, which are described below, are discussed in more detail in the attached memos.

PROPOSALS FOR EMPLOYEES

Employee/Passenger Limo Routes

Two north shore employee/passenger limo routes have been indentified. The proposed routes, hours of service, and employee fares are shown below.

ROUTE	MINUTES FROM AIRPORT	ONE-WAY FARE (RANGE)	ROUTE STOPS
Airport			
Revere	15	$ .75 - $1.75	RT. 1 & Squire St.
Saugus	25	$1.00 - $2.50	RT. 1 & Main St.
S. Lynnfield	35	$1.00 - $3.00	RT. 1 & Lynnfield St.
Danvers	50	$1.00 - $3.50	RT. 1 & RT. 35
Airport			
Lynn	20	$ .75 - $2.00	RT.1A& Common St.
Swampscott	30	$1.00 - $2.75	RT.1A& Tedesco
Marblehead	35	$1.00 - $3.00	Tedesco & Pleasant St.
Salem	45	$1.00 - $3.00	RT. 1A & Derby St.

On both routes, hourly service would be offered from 5:30 a.m. to 11:30 p.m. on weekdays and weekends. In addition, half hour service would be offered on weekdays during the peak periods of 6:00 a.m. to 8:30 a.m. and 2:30 p.m. to 5:00 p.m.

Connection with MBTA Express Buses

MBTA express buses from Salem, Lynn and Marblehead to downtown Boston could stop at or near the Wood Island station. Massport shuttle buses would provide express bus riders with a connection to the Airport. The shuttle bus would match the MBTA's express schedule with stops every fifteen minutes in the peak periods and every half hour at other times between 5 a.m. and 11:30 p.m. On weekends, connecting service would be offered every half hour at all times. The shuttle bus fare would be a quarter. The MBTA express bus schedules, routes and fares are shown below.

450 SALEM — BOSTON VIA HIGHLAND & WESTERN AVE

WEEKDAY		SATURDAY		SUNDAY	
Leave Wash. St. at Lynde	Leave Haymarket Square	Leave Wash. St. at Lynde	Leave Haymarket Square	Leave Wash. St. at Lynde	Leave Haymarket Square
6 00	6:45	7 30	7 30	11.45	-
6 15	7.45	8 20	8 30		
6 30	8:00	9 20	9.30		
6 45	8 05f	10 20	10 30		
7.00	9 00	11.20	11.30		
7:15	10:00				
7:25a	11:00				
7.30					
7 35e					
7 45					
7 50a					
8.00					
8 15					
8 45a					
8:50					
9:15					
9 50					
10:50					
11:50					
12:50	**12:00**	**12:20**	**12:30**	**1:15**	**12:45c**
1:50	**1:00**	**1:20**	**1:30**	**2:45**	**2:00**
2:50	**2:00**	**2:20**	**2:30**	**4:15**	**3:30**
3:15	**3:00**	**3:20**	**3.30**	**5:45**	**5:00**
3:50	**4:00**	**4.20**	**4:30**		
4:15	**4:20**	**5:20**	**5:30**		
4:40	**4:30b**				
4:55	**4:40**				
5:25	**4:50**				
	5:00b				
	5:08				
	5:13b				
	5:18d				
	5:23				
	5:35b				
	5:50				
6:15	**6:05**	**6:20**	**6:30**	**7:15**	**6:30**
7:15	**6:30**	**7:15**	**8:00**	**8:45**	**8:00**
8:45	**8:00**	**8:45**	**9:30**		**9:30**
	9:30				

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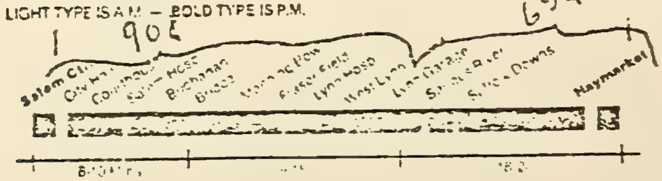
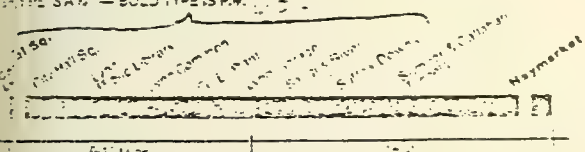


LYNN — BOSTON VIA LYNN COMMON

	WEEKDAY Leave Central Square/Lynn Via Lynn Common	WEEKDAY Via Gen. Edw. Bridge	SATURDAY Via Lynn Common	SATURDAY Via Gen. Edw. Bridge	SUNDAY Via Lynn Common	SUNDAY To Wonderland Via Gen. Edw.
A.M.	[illegible]	6:30 7:00 7:15 7:23 7:30 7:45 8:00 8:15 8:30 9:02 9:15 9:35 9:50 EVERY 30 MIN. UNTIL 11:50	5:50 6:2[illegible] 6:45 7:17 7:35 EVERY 30 MIN. UNTIL 11:35	6:50 7:50 8:50 9:50 10:50 11:20 11:50	7:00 8:00 EVERY 30 MIN. UNTIL 11:30	11:00
P.M.	[illegible] EVERY 30 MIN. UNTIL [illegible]	12:20 EVERY 30 MIN. UNTIL 3:50 4:00 4:20 4:40 4:50 5:20 5:50	12:05 EVERY 30 MIN. UNTIL 5:35 5:55	12:20 EVERY 30 MIN. UNTIL 5:50	12:00 EVERY 30 MIN. UNTIL 5:30	12:00 1:00 2:00 3:00 4:00 5:00
P.M.	[illegible]	6:20 6:50 7:43 8.43 9:43 10:43	6:25 7:25 8:25 9.25 10:25 11:0[illegible] 11:25 12:1[illegible] 12:3[illegible]	6:43 7:43 8:43 9:43 10:43	6:00 EVERY 30 MIN. UNTIL 11:00 11:20 11:30 12:00 12:45	6:00

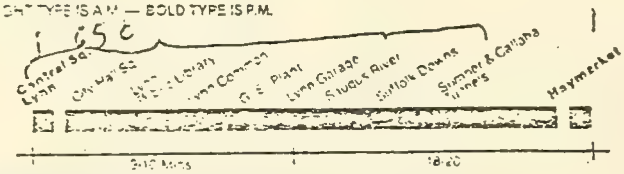
LIGHT TYPE IS A.M. — BOLD TYPE IS P.M.



BOSTON — LYNN VIA LYNN COMMON

	WEEKDAY Leave Haymarket Square/Boston Via Lynn Common	WEEKDAY Via Gen. Edw. Bridge	SATURDAY Via Lynn Common	SATURDAY Via Gen. Edw. Bridge	SUNDAY Via Lynn Common	SUNDAY Leave Wonderland Via Gen. Edw.
A.M.	6:05 6:25 7:00 7:25 7:30 8:00 8:12 8:25 8:50 EVERY 30 MIN. UNTIL 11:50	7:00 7:15 8:05 8:15 8:30 8:45 EVERY 30 MIN. UNTIL 11.45	6:20 6:50 EVERY 30 MIN. UNTIL 11.50	8:15 9.15 10.15 11:15 11:50	7.30 8.30 9.30 10:00 10.30 11:00 11:30	11:30
P.M.	12:20 EVERY 30 MIN. UNTIL 3:50 4:17 4:32 4:47 5:02 5:17 5.25 5:32 5.47	12:15 EVERY 30 MIN. UNTIL 4:15 4:30 4.40 4.50 5:10 5:20 5:35 5:55	12:20 EVERY 30 MIN. UNTIL 5:20 5:45	12:15 12:50 1:15 1:50 2:15 2:50 3:15 3:50 4:15 4:50 5:15 5:50	12:00 EVERY 30 MIN. UNTIL 5.30	12:30 1:30 2:30 3:30 4:30 5:30
P.M.	6:02 6.32 7:00 7:25 8:00 9:00 10:00 11:00 12:00 1.19	5:15 7:15 8:15 5:15 10:15 11:15	6:05 7:00 8:00 9:00 10:00 11:00 12:00 1.19	6:15 7:15 8:15 9:15 10:15 11:15	6:00 EVERY 30 MIN. UNTIL 12:30 1:19	6:30

LIGHT TYPE IS A.M. — BOLD TYPE IS P.M.

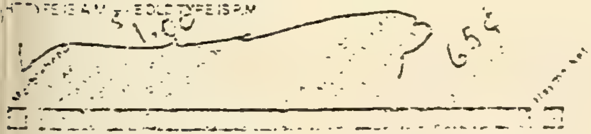


MARBLEHEAD — BOSTON VIA CENTRAL SQ. LYNN

	WEEKDAY Leave Marblehead via Paradise Road	WEEKDAY via Humphrey Street	SATURDAY via Paradise Road	SATURDAY via Humphrey Street	SUNDAY via Humphrey St. & Western Ave.
A.M.	6:47 7:17 7.47 8:17 8:47 9:17 10:17 11:17	5:50 6:10 6:30 7:02 7:15 7:32 8:05 8:32 9:05 [illegible] 10:47 11:47	6:20 7:20 8:17 9:17 10:17 11:17	7:00e 8:00e 9:00e 10:00e 10:50 11:50	8:30 9:30 10:30 11:30
P.M.	12:17 1:17 2:17 3:17 4:17 5:20 5:50	[illegible] 1:47 2.45 3:47 4:47 5:43d	12:17 1:17 2:17 3:17 4:17 5:17	12:50 1:50 2:50 3:50 4:50 5:50d	12:30 1:30 2:30 3:30 4:30 5:30
P.M.	6:20 6:50d	6:05d 6:25d 6:35d 7:15 8:15 9:15 10:15 11:10d 12:10	6:45d	6.15 7.15 8.15 9:15 10:15 11:10d 12:10d	6:30 7:30 8:30 9:30 10:30 11:30 12:30

LIGHT TYPE IS A.M. — BOLD TYPE IS P.M.

$1.00 65¢



BOSTON — MARBLEHEAD VIA CENTRAL SQ. LYNN

	WEEKDAY via Paradise Road	WEEKDAY via Humphrey Street	SATURDAY via Paradise Road	SATURDAY via Humphrey Street	SUNDAY via Humphrey St. & Western Ave.
Leave Haymarket Square/Boston	7:15 8:15 9:15 10:15 11:15 12:15 1:15 2:15 3:15 4:15 4:50 5:15h 5:20 5.55	7:00 8:05 8:45 9:45 10:45 11:45 12:45 1:45 2:45 3:45 4:30b 4:40 5:05h 5:10b 5:25h 5:35 6:15 7:15 8:15 9:15 10:15 11:15 12:00g	8:15 9:15 10:15 11:15 12:15 1:15 2:15 3:15 4:15 5:15	11:50 12:50 1:50 2:50 3:50 4:50 5:50 6:15 7:15 8:15 9:15 10:15 11:15	8:30 9:30 10:30 11:30 12:30 1:30 2:30 3:30 4:30 5:30 6:30 7:30 8:30 9:30 10:30 11:30
Leave Central Square	6:15 6:45 7:15 7:45 8:15 8:45 9:45 10:45 11:45 12:45 1.45 2.45 3.45 4.45 5.20 5.50 6.25	5:35a 5:45 6:00 6:30 6:55a 7:00 7:35 8:02 8:35 9:15 10:15 11:15 12:15 1.15 2.15 3:15 4.15 5:00a 5:10 5:40a 6.05 6:45 7:45 8:45 9:45 10:45 11:45 12:[illegible]	5:55 6:5[illegible] 7:55 8:45 9:45 10:45 11:45 12.45 1.45 2:45 3:45 4:45 5.45	6:45a 7:45a 8:45a 9:45a 10:20 11:20 12:20 1:20 2:20 3.20 4:20 5:20 6.15 6:45 7:45 8:45 9:45 10.45 11:45	8:10 9:00 10:00 11:00 12:00 EVERY 60 MIN UNTIL 11:00 12:00

New Shuttle Bus Route

The same shuttle bus which connects with the express buses could also run up to Orient Heights. This would serve employees using the Winthrop bus which stops at Orient Heights and would serve airport employees living in East Boston. Again, the service would run every fifteen minutes in peak periods and every half hour in off-peak periods.

The new service would also attract employees working in the north apron area. They currently don't have easy access to the Blu Line. The new shuttle bus could provide this access to Wood Island. Their ridership may also allow the shuttle bus to run with a continuous 15 minute lead time from 5:00a.m. to 11:30 p.m.

Carpooling

A carpooling program will soon begin at the airport for employees working in the north apron area. It may also be started for the airport as a whole if the north apron program is successful.

Reduced Transit Fares

Employers could save money by providing free or half price MBTA passes to employees. The average purchase price of MBTA passes is $15.70.

Massport could also provide free or half price shuttle bus coupons to airport employees.

Employees Required to Pay Parking Fees

Massport contracts with airport employers might be renegotiate so that employees would have to pay their own parking fees. (75.00/ quarter). Employers may also decide on their own to pass on the parking cost to their employees.

PROPOSALS FOR PASSENGERS

Limousine Routes

Five potential limo routes have been identified.

Route ✓	XCPT STOP #	Minutes from Airport	One-Way Fare	Route Stops
Airport				
Medford	105	15	$ 6.50	I93 & Rt. 60
Arlington	106	20	7.50	Rt. 60 & Rt. 2A
Lexington	107	30	8.50	Rt. 2 & Rt. 225
Concord	108	45	10.00	Rt. 2 & Main St.
Acton	109	55	11.00	Rt. 2 & Rt. 27

[illegible]

Hours:

Weekdays: Arr. Logan 6:55 a.m. - 9:55 p.m. hourly
Lv. Logan 7:00 a.m. -10:00 p.m. hourly

Weekends: Arr. Logan 7:55 a.m. - 9:55 p.m. hourly
Lv. Logan 8:00 a.m. -10:00 p.m. hourly

Route ✓				
Airport				
Waltham	110	35	$ 9.00	Rt. 128 & Rt. 20
Wayland	111	45	10.00	Rt. 20 & Rt. 126
Sudbury	112	50	11.00	Rt. 27 & Union St.

[illegible] Wayland (next page)

Weekdays: Arr. Logan 6:50 a.m. - 9:50 p.m. hourly
Lv. Logan 7:00 a.m. -10:00 p.m. hourly
Weekends: Arr. Logan 8:50 a.m. - 9:50 p.m. hourly
Lv. Logan 9:00 a.m. -10:00 p.m. hourly

Route	XCAST STOP #	Minutes from Airport	One-way Fare	Route Stops
Airport				
Medford	105	15	$6.50	I93 & Rt. 60 ✓
Arlington	106	20	$7.50	Rt. 60 & Rt. 2A
Lexington	107	30	$8.50	Rt. 2 & Rt 2~~2~~5 2
Waltham	110	40	$9.50	Rt. ~~2~~ 20 & Main St. (Main & 1…
Wayland	111	50	$10.50	Rt. ~~2~~ 20 & Rt. 27 ✓

Combined w/ Acton Route

Combined w/ Sudbury Route

Hours:

Weekdays: Arr. Logan 6:50 a.m. – 9:50 p.m., hou…
Lv. Logan 7:00 a.m. –10:00 p.m., hou…

Weedends: Arr. Logan 7:50 a.m. – 9:50 p.m., hou…
Lv. Logan 8:00 a.m. –10:00 p.m., hou…

Route				
Airport				
Lynn	101	25	$7.50	Rt. 1A & Common St.
Swampscott	102	30	$8.50	Rt. 1A & Tedesco
Mablehead	103	35	$8.50	Tedesco & Pleasant St.
Salem	104	45	$9.50	Downtown Salem on Rt. 1

Hours:

Weekdays: Arr. Logan 6:45 a.m. – 9:45 p.m. hour… except at 11:45 a.m., 2:45 p.m. and 8:45 p.m.
Lv. Logan 7:00 a.m. –10:00 p.m. hour… except at noon, 3:00 p.m., and 9:00 p.m.

Weedends: Arr. Logan 8:45 a.m. – 9:45 p.m. hour… except at 11:45 a.m., 2:45 p.m., … 8:45 p.m.
Lv. Logan 9:00 a.m. –10:00 p.m. hour… except at noon, 3:00 p.m., and 9:00 p.m.

These hours of service would be offered if employees did not share the service. The employee/Passenger limo service schedule is described on page 2.

Routes:	XCAST STOP #	Minutes from Airport	Fare	Route Stops
Airport				
Newton		(Service already exists)		
✓ Wellesley (new extension)	113	50	$10.50	Rt. 9 & Rt. 16

Hours:

Weekdays: Arr. Logan 6:30 a.m. - 8:30 p.m. hourly
Lv. Logan 6:40 a.m. - 8:40 p.m. hourly

Weekends: Arr. Logan 12:30 p.m.-10:30 p.m. hourly
Lv. Logan 12:45 p.m.-10:45 p.m. hourly

Route:				
Airport				
Dedham	114	30	$ 8.50	Rt. 128 & Rt. 1A
Norwood	115	40	$ 9.50	I95 & Neponset
Walpole	116	50	$10.50	I95 & Rt. 27

Hours:

Weekdays: Arr. Logan 6:50 a.m. - 9:50 p.m. hourly except at 11:50 a.m., 2:50 p.m. and 8:50 p.m.

Weekends: Arr. Logan 8:50 a.m. - 9:50 p.m. hourly except at 11:50 a.m., 2:50 p.m. and 8:45 p.m.
Lv. Logan 9:00 a.m. -10:00 p.m. hourly except at Noon, 3:00 p.m. and 9:00 p.m.

Downtown Limousine Service

Limousine service to downtown Boston could run more frequently. It is proposed that limos operate with a fifteen minute lead time from 6:30 a.m. to 11:30 p.m. Further, the limos could make two or three stops in the central business district besides stopping at Boston hotels.

Free Shuttle Bus Service

Shuttle bus service might be free for both travellers and employees.

New Shuttle Bus Service

The proposed service connecting with MBTA express buses and the Winthrop bus would attract some air passengers.

Increased Parking Fees

A number of different pricing alternatives will be tested.

These options have been identified primarily for CSI modeling. Corrections or additions to this list of alternatives should be completed by the end of this week so that we can meet CSI's schedule.

John

TABLE 5

Express Bus Stops

1	Concord, NH	26	Lowell
2	Manchester, NH	27	Tewksbury
3	Derry, NH	28	Worcester
4	Salem, NH	29	Westboro
5	Methuen	30	Southboro (Fayville)
6	Andover	31	Framingham Exit 12
7	Woburn, South	32	Framingham Center
8	Billerica	33	Framingham Shoppers World
9	Bedford	34	Dover, NH
0	Burlington	35	Durham, NH
1	Woburn, North	36	Pease AFB
2	Stoneham	37	Porthsmouth, NH
3	Wakefield	38	Hampton, NH
4	Peabody, East	39	Seabrook, NH
5	Saugus	40	Middlebury, VT
6	Danvers	41	Montpelier, VT
7	Peabody, West	42	Montreal, Quebec
8	Brockton	43	New London, NH
9	Randolph	44	Peterboro, NH
0	Braintree	45	Portland, ME
1	Newton	46	Rutland, VT
2	Milford, NH	47	St. Albans, VT
3	Merrimack	48	Sherburne, VT
4	Nashua, NH	49	Springfield, VT
5	Chelmsford	50	Vergennes, VT

TABLE 5 (continued)

Express Bus Stops

51	Waterbury, VT	75	Hyannis
52	WRJ VT	76	Foxboro
53	Winchendon, VT	77	Providence, RI
54	Woodstock, VT	78	Springfield, MA
55	Augusta, ME	79	Holyoke
56	Barry, VT	80	East Hampton
57	Bellows Falls, VT	81	Northhampton
58	Brattleboro, VT	82	Hadley, South Hadley
59	Burlington, VT	83	Amherst
60	Claremont, NH	84	UMASS
61	Concord, NH	85	Bradley
62	Fitchbury Jct, NE	86	Shrewsbury
63	Fitzwilliam, NH	87	Plymouth
64	Gardner, ME	88	Revere
65	Hanover, NH	89	Milton, East Milton
66	Keene, NH	90	Duxbury
67	Ludlow, VT	91	Pawtucket
68	Manchester, NH	98	Logan Hilton
69	Hingham	99	Downtown Hotel Megastop
70	Hanover		
71	Marshfield		
72	Kingston		
73	Sagamore		
74	Sandwich		

APPENDIX 4:
AIR QUALITY

APPENDIX 4:
AIR QUALITY

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1.0 AIR QUALITY ANALYSIS METHODS AND INPUT DATA

The air quality analysis of the Cntral Artery Depression/Third Harbor Tnnel project consisted of the etimation of carbon monoxide (CO), oides of nitrogen (NO_x), and nnmethane hydrocarbons (NMHC) eissions from all motor vehicles in a taffic-affected area that includes mst of downtown Boston, East Boston, ad South Boston. From these eissions, an estimation was made of te maximum one-hour and eight-hour CO ad one-hour nitrogen dioxide (NO_2) cncentrations from motor vehicle surces for baseline conditions (1982) ad for the No-Build and Preferred Aternatives for the years 1990 and 210. This technical appendix does nt contain the results of the air qality analysis; rather, it details te modeling procedures and the input dta that were used to arrive at the rsults. (See Section 4.7 of the FIS/FEIR for the results of the air qality analysis.)

1.1 Estimating Emissions from Motor Vehicle Sources

Massachusetts vehicle rgistration data for the light-duty vhicle class (comprising all of the pivate passenger automobiles) were ued. These data were provided by the Cmmonwealth of Massachusetts Dpartment of Environmental Quality Egineering (DEQE) and appear in Table 1of the DEIS/DEIR Appendix 5 along wth national registration data for te other vehicle classes.

Dstribution of Vehicle-Miles-Traveled (VMT) According to Vehicle Category

The regional distribution of VT was used to develop a composite eission factor and was agreed upon on csultation with DEQE. It is eplained in Section 1.1 of the DIS/DEIR Appendix 5.

Mix of Cold, Stabilized, and Hot Transient Operations

Automobile exhaust emission rates are influenced by the temperature (or operating phase) of the engine. The percentages of travel by operating phase were agreed upon in consultation with DEQE and are given in Section 1.1 of the DEIS/DEIR Appendix 5.

Ambient Temperature

Emission rates of CO decrease with increasing ambient temperatures. In estimating CO emissions, an ambient temperature of 30°F was assumed. For NO_x and NMHC, a temperature of 75°F was used. These temperatures were agreed upon in consultation with DEQE.

Traffic Volume Data

Traffic volumes are used along with emission factors to obtain emission rates. Traffic volume data were developed by the Central Transportation Planning Staff, HFMW and Vanasse-Hangen Design, Inc. [2] in a number of formats depending on end use. The formats include traffic on local streets, the expressways, the tunnels, and a number of selected intersections.

Figure 1 shows the various roadway links and their identification codes that were used in describing the traffic volumes for downtown Boston. Similar schematics are shown for South Boston in Figures 2, 3 and 4 and East Boston in Figure 5. Table 1 shows the 1-hour, 8-hour and 24-hour traffic volumes for the various road links for the existing (1982) condition, and the No-Build Alternative in 1990 and 2010. Roadway links in downtown Boston, East Boston and South Boston are all included in this table. Similar data for the Preferred Alternative for 1990 and 2010 are

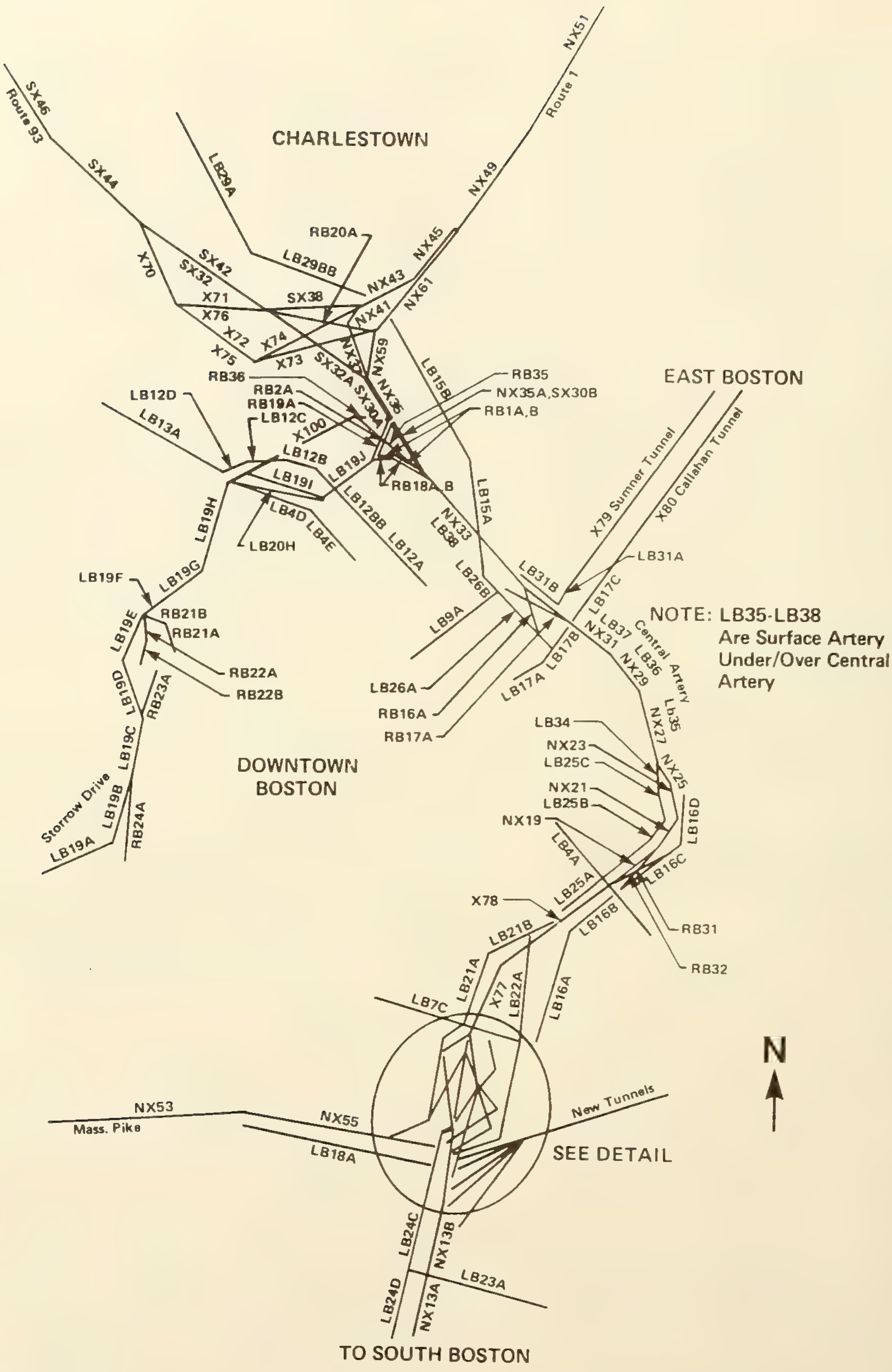
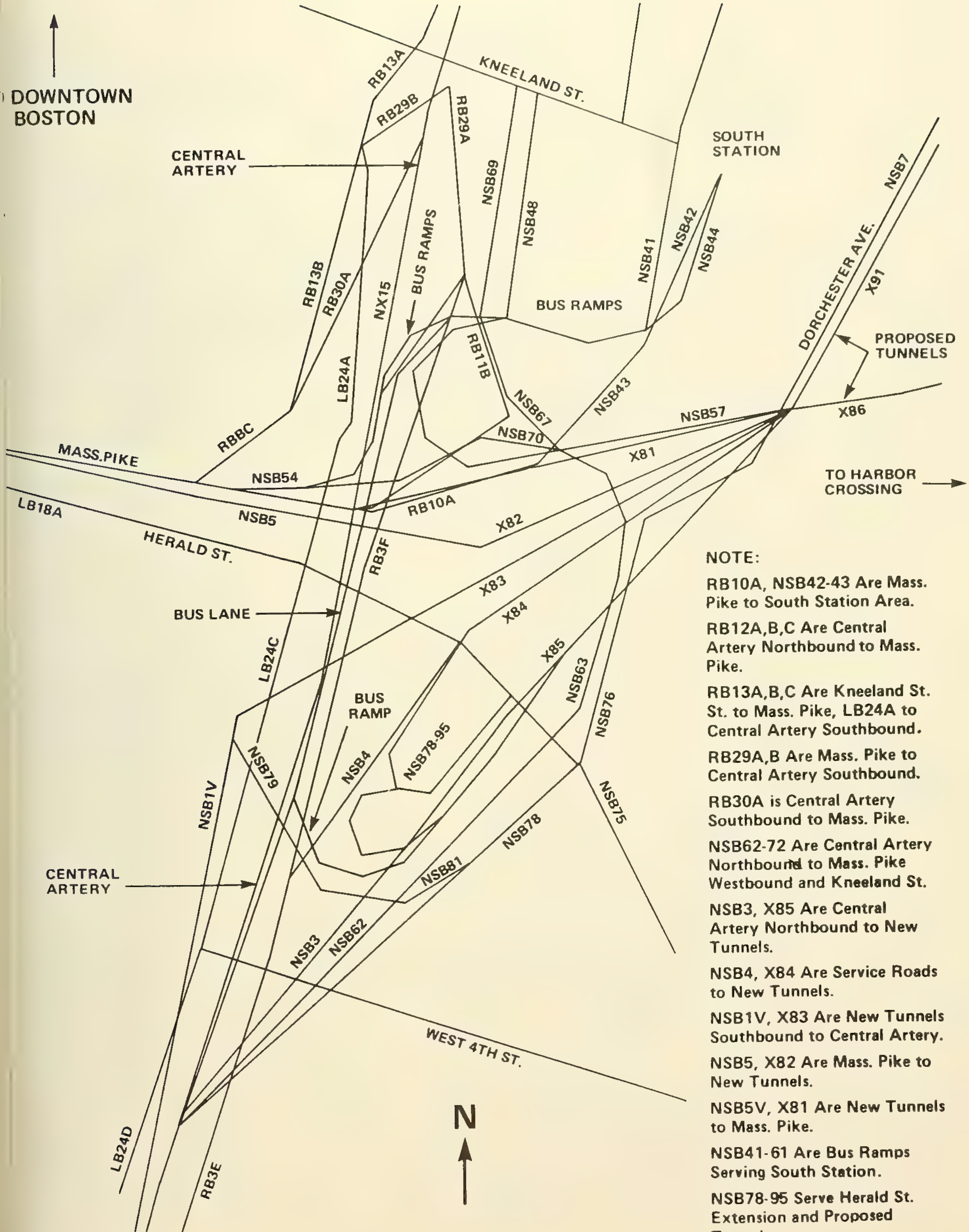


Figure 1

Road Network for Downtown Boston, as Used in the Air Quality Modeling Analysis

EIS/EIR for 1-90 – Third Harbor Tunnel; 1-93 – Central Artery



NOTE:

RB10A, NSB42-43 Are Mass. Pike to South Station Area.

RB12A,B,C Are Central Artery Northbound to Mass. Pike.

RB13A,B,C Are Kneeland St. St. to Mass. Pike, LB24A to Central Artery Southbound.

RB29A,B Are Mass. Pike to Central Artery Southbound.

RB30A is Central Artery Southbound to Mass. Pike.

NSB62-72 Are Central Artery Northbound to Mass. Pike Westbound and Kneeland St.

NSB3, X85 Are Central Artery Northbound to New Tunnels.

NSB4, X84 Are Service Roads to New Tunnels.

NSB1V, X83 Are New Tunnels Southbound to Central Artery.

NSB5, X82 Are Mass. Pike to New Tunnels.

NSB5V, X81 Are New Tunnels to Mass. Pike.

NSB41-61 Are Bus Ramps Serving South Station.

NSB78-95 Serve Herald St. Extension and Proposed Tunnels.

igure 2
etail of Massachusetts Turnpike / Central Artery / Proposed Tunnel / South Station
iterchange, as Used in the Air Quality Modeling Analysis
S/EIR for I-90 – Third Harbor Tunnel; I-93 – Central Artery

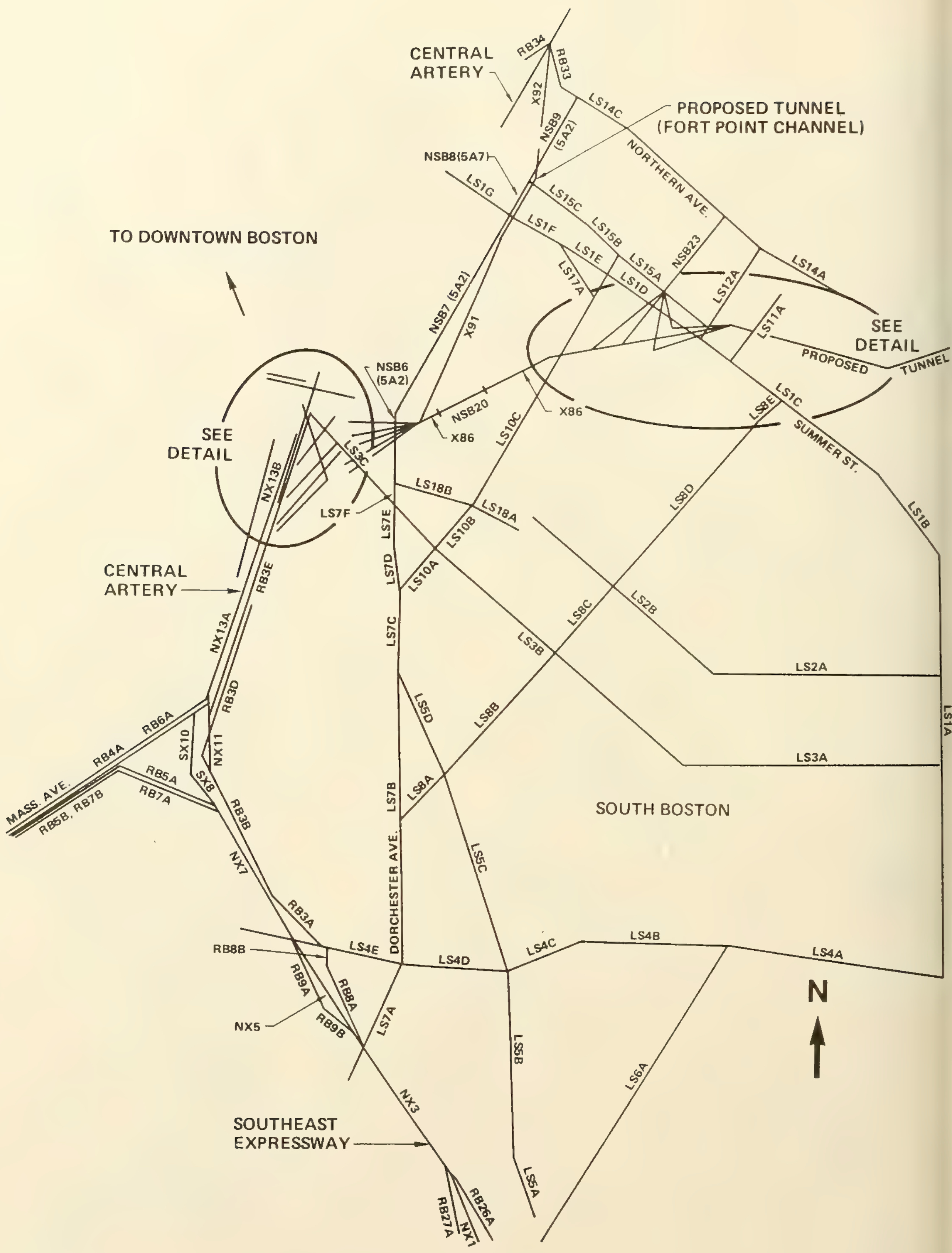
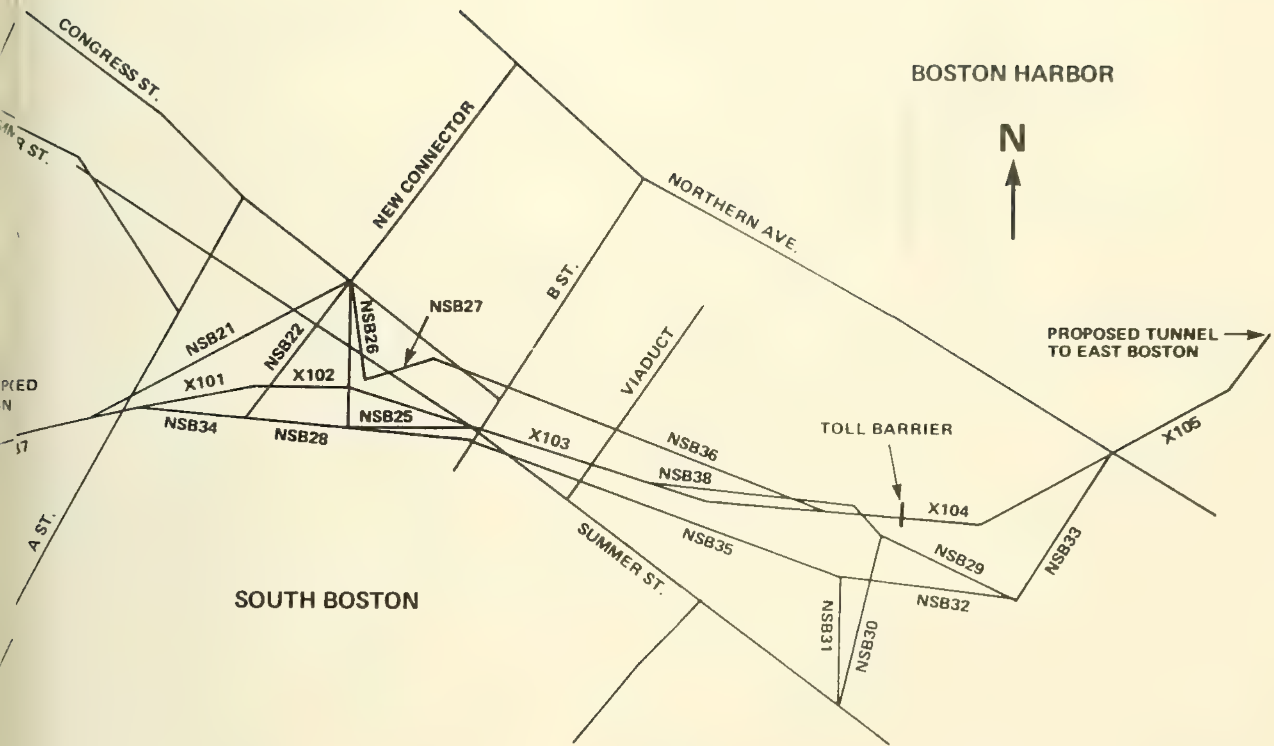


Figure 3

Road Network for South Boston, as Used in the Air Quality Modeling Analysis

EIS/EIR for 1-90 – Third Harbor Tunnel; 1-93 – Central Artery



ul 4

etil of Proposed Tunnel Corridor in South Boston, as Used in the Air Quality
eling Analysis

/R for 1-90 – Third Harbor Tunnel; 1-93 – Central Artery

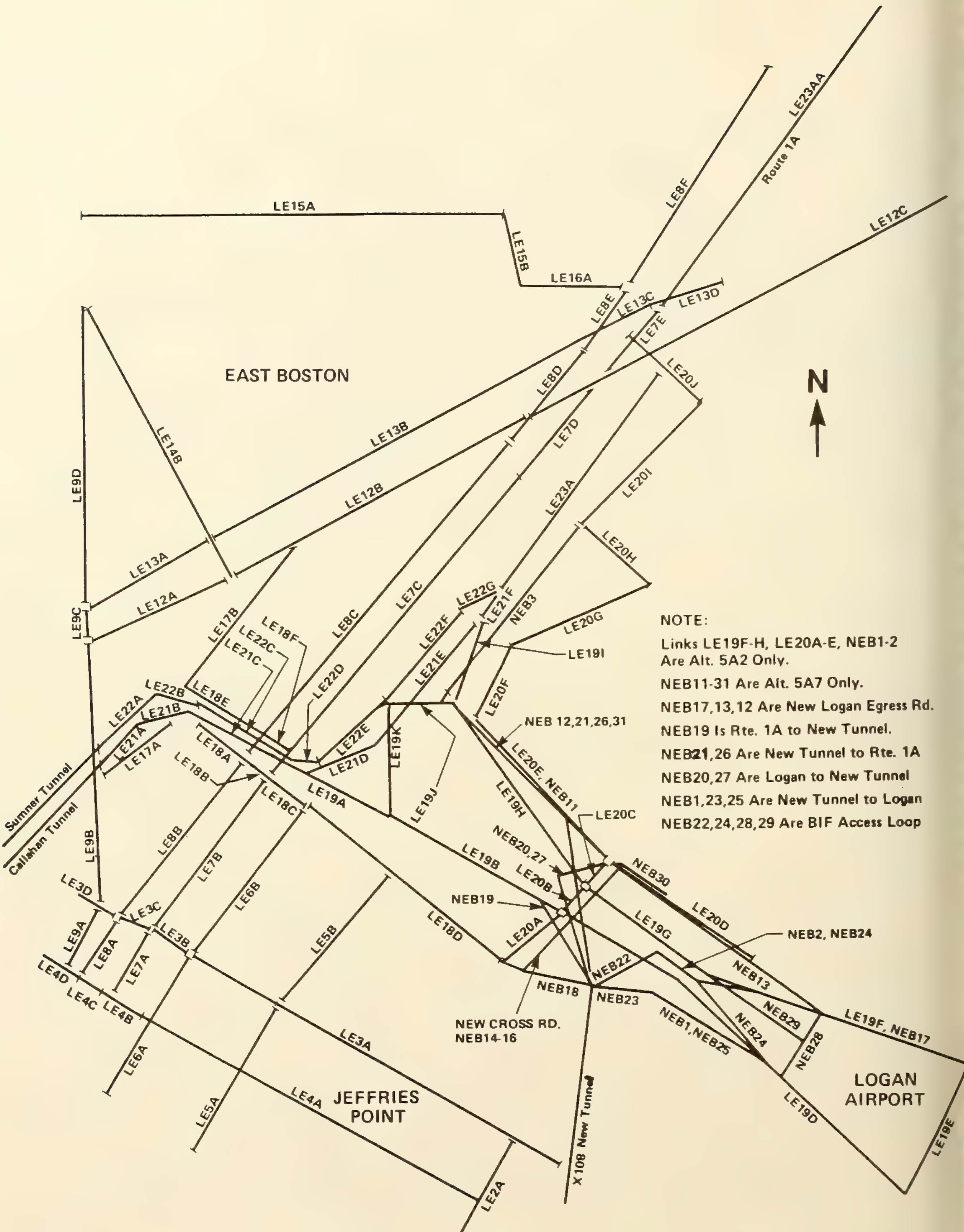


Figure 5

Road Network for East Boston, as Used in the Air Quality Modeling Analysis

EIS/EIR for 1-90 – Third Harbor Tunnel; 1-93 – Central Artery

esented in Table 2. More detailed escription of the traffic data used nd the estimation procedures are ivn in Appendix 4 - Traffic of the DES/SDEIR, and Section 4.2 of the EI/FEIR.

In addition to the free flow afic, detailed analysis of a number otential traffic congestion ctions in the study area was made r all alternatives. These locations cude the 14 intersections analyzed eiously, the Callahan Tunnel tance, the existing Sumner and lahan toll plazas, and the toll aas associated with the proposed nel. In addition, two more trsections were analyzed for the eerred Alternative. These trsections were chosen because the oect is expected to have gificant traffic effects at these ctions. To ensure consistency og all alternatives, these trsections were also analyzed for eNo-Build Alternative. The two dtional intersections are Summer ret/Tunnel Ramps and Northern eue/East Tunnel Ramps. Tables 3 rugh 42 show tne one-hour and eage eight-hour demand volumes, poach capacities, signal cycle ms, green phase times, and the mer of lanes per approach for each trsection for all project trnatives. Demand volumes, queue nths, and wait times for toll aas are shown in Tables 43 through .

icle Speeds

Emission factors vary with eage vehicle speed. The average icle (free flow) speeds that were d in the analysis were supplied by M. They vary with the averaging e periods, the type of facility, d the location. For each facility, bur, 8-hour, and 24-hour speeds e estimated as shown in Tables 48 49.

dit for Inspection and Maintenance

Following consultation with EPA DEQE, it was decided that modeling analysis for the Third Harbor Project would be based on no I/M credit. The effects of I/M on emissions are discussed in Part I of the DEIS/DEIR Appendix 5, Section 1.1.

1.2 Emissions, Ventilation Requirements, and Concentrations in the Tunnels

The emission rates in the various tunnel segments were estimated according to a procedure given in the DEIS/DEIR Appendix 5, Section 1.2. The demand traffic volumes, the tunnel segment lengths, and the average vehicle speed in the existing tunnels for all project alternatives are given in Table 50. Similar data are given in Table 51 for the proposed tunnel. Emission characteristics are shown in Table 52.

Ventilation Requirements

For the existing Sumner, Callahan, and Dewey Square Tunnels, the Massachusetts Turnpike Authority and the Massachusetts Department of Public Works provided ventilation fan capacity data [3,4] for the analysis. The capacities for the individual ventilation buidings are given in Table 35 of the DEIS/DEIR Appendix 5.

For the proposed tunnel, the ventilation requirement is based on the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE's) criterion of 155 liters per meter per lane per second. An example computation of the ventilation requirements for the Preferred Alternative in 1990 is given in Table 53.

Pollutant Concentrations

The average concentration of CO and NO_2 in a given tunnel segment was estimated according to the procedure given in the DEIS/DEIR Appendix 5, Section 1.2. Results are shown in Table 53.

1.3 Diffusion Modeling Analysis

After the pollutants are

discharged into the atmosphere by the various emission sources, the pollutants are transported by the prevailing wind and diluted through dispersion by atmospheric turbulence. The resulting pollutant concentration at any location in the study area is dictated by the rate of emission of the pollutant sources, the spatial distribution of the emission sources, and the meteorology variables.

Estimating Pollutant Concentrations from Motor Vehicle Sources

Ambient CO concentrations caused by motor vehicles on the expressways, arteries, local streets, and toll plazas were estimated by the Federal Highway Administration's CALINE 3 Model [5]. For the vent building analysis, EPA's ISC Model [6] was used. Input data are shown in Table 54 for the 1990 Preferred Alternative example. The various input elements to the modeling analysis are described in the DEIS/DEIR Appendix 5, Section 1.3.

Emission Rates

Emission rates for automotive sources are specified as emissions of CO per unit time per unit length of roadway. These emission rates are estimated according to EPA's indirect source guidelines [7] and are described in the DEIS/DEIR Appendix 5, Section 1.3.

Spatial Distribution of Emission Sources and Receptor Locations

Because of the extent of the project area, many receptors were selected from downtown Boston, East Boston, South Boston, and Revere. These receptors represent areas that the public has access to over time periods that correspond to the applicable air quality standards. The receptors shown in Figure 6 include recreational facilities (e.g., Rotch Playground and Porzio Park), residences (e.g., Heritage Apartments in East Boston, and Bell Circle residences), and areas with high public access (e.g., Quincy Market and Atlantic Avenue by the Federal Reserve Bank).

Meteorological Variables

The primary variables affecting the dispersion of pollutants are wind speed and direction, atmospheric stability, and the vertical thickness of the mixing layer. These are described in more detail in the DEIS/DEIR Appendix 5, Section 1.3.

Background CO Concentrations

The background concentration is the level resulting from the sources other than the immediate adjacent streets, expressways, toll plazas, and ventilation building that were considered directly n the modeling analysis. Consistent with the modeling assumptions used in the DEIS/DEIR, a one-hour CO background of 4.4 parts per million (ppm) was assumed for 1980. The rollback technique was used to arrive at a 4.0 ppm background for 1982, 2.1 ppm for 1990, and 1.6 ppm for 2010. Eight-hour background levels were established by applying a 0.8 persistence factor to the background levels described above, as agreed upon in consultation with the EPA.

Estimating NO_2 Concentrations from the Vent Buildings

Maximum one-hour NO_2 concentrations were estimated by two separate procedures: 1) using EPA's ISC model for the basic set of receptors that are located typically more than 100 meters away from the nearest vent; and 2) using Halitsky's "near-field" model [8] for receptors at building air-intakes or pedestrian sidewalk levels that are located less than or equal to 100 meters from the vent. These procedures are explained in the DEIS/DEIR Appendix 5, Section 1.3 and the SDEIS/SDEIR Appendix 5, Section 1.3.

Background NO_2 Concentrations

Following discussions with DEQE, the 1-hr. NO_2 background concentrations that are used in the

impact assessment are 170 ug/m^3 for sites in East Boston, and 224 ug/m^3 for all other sites.

REFERENCES

1. "User's Guide to MOBILE 2," U.S. Environmental Protection Agency, Office of Mobile Source Air Pollution Control, Report No. EPA-460/3-81-006, Ann Arbor, MI, February 1981.

2. HFMW, Waltham, MA, Personal communications, July, August and September 1983.

3. Massachusetts Turnpike Authority, Boston, MA, Personal communications, September 1982.

4. Massachusetts Department of Public Works, Boston, MA, Personal communications, September 1982.

5. "CALINE 3 - A Versatile Dispersion Model for Predicting Air Pollutant Levels Near Highways and Arterial Streets," California Department of Transportation, Report No. FHWA/CA/TL-79/23, November 1979.

6. "Industrial Source Complex (ISC) Dispersion Model User's Guide," U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Report No. EPA-450/4-79-030, Research Triangle Park, NC December 1979.

7. "Guidelines for Air Quality Maintenance Planning and Analysis, Volume 9 (Revised): Evaluating Indirect Sources," U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 1978.

8. Halitsky, James, "Gas Diffusion Near Buildings," Chap. 5-5, Meteorology and Atomic Energy, U.S. Atomic Energy Commission, Office of Information Services, Silver Springs, MD, July 1968.

TABLE 1

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
NX1	8198.	64042.	133420.	11766.	80640.	168000.	12691.	82032.	170900.	XWAY 2WAY
NX3	9700.	77904.	162300.	14319.	80640.	168000.	15355.	82032.	170900.	XWAY 2WAY
NX5	9550.	70968.	147850.	14282.	80352.	167400.	16243.	81456.	169700.	XWAY 2WAY
NX7	10350.	78312.	163150.	15355.	78144.	162800.	16983.	79392.	165400.	XWAY NB
NX11	2500.	27456.	57200.	4255.	31488.	65600.	4847.	31824.	66300.	XWAY NB
NX13A	9450.	73776.	153700.	13320.	80256.	167200.	14245.	81312.	169400.	XWAY 2WAY
NX13B	6553.	66288.	138100.	6068.	74688.	155600.	7067.	76272.	158900.	XWAY 2WAY
NX15	5189.	53280.	111000.	9546.	57552.	119900.	10027.	59088.	123100.	XWAY NB
NX19	6532.	69024.	143800.	9472.	66816.	139200.	11137.	68496.	142700.	XWAY NB
NX21	6262.	69720.	145250.	9398.	72576.	151200.	9871.	74880.	156000.	XWAY NB
NX23	6262.	69720.	145250.	9398.	72576.	151200.	9871.	74880.	156000.	XWAY NB
NX25	7602.	78960.	164500.	10952.	81024.	168800.	11433.	83232.	173400.	XWAY NB
NX27	7602.	78960.	164500.	10952.	81024.	168800.	11433.	83232.	173400.	XWAY NB
NX29	7602.	78960.	164500.	10952.	81024.	168800.	11433.	83232.	173400.	XWAY NB
NX31	8042.	77616.	161700.	10656.	80400.	167500.	11248.	83088.	173100.	XWAY NB
NX33	8042.	77616.	161700.	10656.	80400.	167500.	11248.	83088.	173100.	XWAY 2WAY
NX35	5347.	34008.	70850.	4625.	32496.	67700.	4403.	34080.	71000.	1WAY NB
NX35A	3347.	22680.	47250.	4773.	26400.	55000.	4662.	27216.	56700.	1WAY NB
NX37	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX41	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX43	2180.	17088.	35600.	0.	0.	0.	0.	0.	0.	1WAY
NX45	2180.	17088.	35600.	0.	0.	0.	0.	0.	0.	1WAY SB
NX49	5295.	34800.	72500.	5624.	35424.	73800.	6068.	37968.	79100.	XWAY 2WAY
NX51	5295.	34800.	72500.	5624.	35424.	73800.	6068.	37968.	79100.	XWAY 2WAY
NX53	5260.	34176.	71200.	5920.	38208.	79600.	6586.	38400.	80000.	MASS PIKE
NX55	5260.	34176.	71200.	5920.	38208.	79600.	6586.	38400.	80000.	MASS PIKE
NX59	1953.	14712.	30650.	0.	0.	0.	0.	0.	0.	CITY SQ
NX61	3115.	17712.	36900.	5624.	35424.	73800.	6068.	37968.	79100.	CITY SQ
SX8	5250.	38736.	80700.	8288.	39888.	83100.	8621.	40560.	84500.	1WAY SB
SX10	5250.	38736.	80700.	8288.	39888.	83100.	8621.	40560.	84500.	1WAY SB
SX30A	3710.	34200.	71250.	4023.	38688.	80600.	3996.	39744.	82800.	1WAY SB
SX30B	1890.	23544.	49050.	3034.	24192.	50400.	3034.	25776.	53700.	1WAY SB
SX32	2150.	21768.	45350.	2849.	24768.	51600.	2997.	26160.	54500.	93
SX32A	5354.	39240.	81750.	8658.	38688.	80600.	8399.	39744.	82800.	93

TABLE 1 (CONT'D.)

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
SX38	895.	1872.	3900.	0.	0.	0.	0.	0.	0.	93
SX42	4289.	21168.	44100.	4292.	24288.	50600.	4403.	24720.	51500.	93
SX44	6439.	42936.	89450.	7141.	49056.	102200.	7400.	50880.	106000.	93
SX46	6439.	42936.	89450.	7141.	49056.	102200.	7400.	50880.	106000.	93
NX70	0.	71520.	149000.	740.	5088.	10600.	851.	4800.	10000.	93 OFF SB -US1NB
NX71	0.	0.	0.	1739.	13680.	28500.	1628.	14928.	31100.	93 OFF NB TO US1NB
NX72	0.	0.	0.	2516.	18720.	39000.	2479.	19728.	41100.	93 CONNECT 93S-US1N
NX73	0.	0.	0.	2516.	18720.	39000.	2479.	19728.	41100.	ON TC US1 NB
NX74	0.	0.	0.	1924.	18960.	39500.	1850.	18336.	38200.	OFF US1 SB TO 93SB
NX75	0.	0.	0.	1924.	18960.	39500.	1850.	18336.	38200.	CONNECT US1SB-93NB
NX76	0.	0.	0.	1924.	18960.	39500.	1850.	18336.	38200.	ON TO 93SB
X77	5189.	53280.	111000.	0.	57552.	119900.	0.	59088.	123100.	DEWEY SQ TUNNEL
X78	6532.	69024.	143800.	0.	66816.	139200.	0.	68496.	142700.	DEWEY SQ TUNNEL
X79	2639.	22100.	42500.	0.	19104.	39800.	0.	21408.	44600.	SUMNER TUNNEL
X80	2847	20956.	40300.	0.	20928.	43600.	0.	22656.	47200.	CALLAHAN TUNNEL

TABLE 1

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
RB1A	852.	10656.	22200.	1147.	14304.	29800.	1184.	14736.	30700.	LEV CIRC/XWAY SB
RB1B	852.	10656.	22200.	1147.	14304.	29800.	1184.	14736.	30700.	LEV CIRC/XWAY SB
RB2A	2000.	11328.	23600.	1480.	8304.	17300.	1406.	8304.	17300.	LEV CIRC/XWAY NB
RB3A	493.	5736.	11950.	444.	3888.	8100.	481.	3696.	7700.	ACC/XWAY NB
RB3B	1703.	12360.	25750.	1628.	10992.	22900.	1554.	11664.	24300.	ACC/XWAY NB
RB3D	1703.	12360.	25750.	1628.	10992.	22900.	1554.	11664.	24300.	ACC/XWAY NB
RB3E	2568.	14376.	29950.	2664.	13056.	27200.	2664.	13536.	28200.	ACC/XWAT NB
RB3F	368.	2376.	4950.	1332.	7056.	14700.	1443.	4944.	10300.	ACC/XWAY NB
RB4A	500.	4416.	9200.	74.	4128.	8600.	74.	5376.	11200.	MASS/OFF SB
RB5A	900.	1776.	3700.	1110.	3120.	6500.	1073.	2880.	6000.	MASS/ON SB
RB5B	900.	1776.	3700.	1110.	3120.	6500.	1073.	2880.	6000.	MASS/ON SB
RB6A	200.	3168.	6600.	703.	4656.	9700.	703.	5424.	11300.	MASS/ON NB
RB7A	500.	3720.	7750.	592.	3552.	7400.	592.	4032.	8400.	MASS/OFF NB
RB7B	500.	3720.	7750.	592.	3552.	7400.	592.	4032.	8400.	MASS/OFF NB
RB8A	150.	2328.	4850.	37.	288.	600.	37.	336.	700.	ANDREW OFF NB
RB8B	150.	2328.	4850.	37.	288.	600.	37.	336.	700.	ANDREW OFF NB
RB9A	800.	7344.	15300.	1073.	4848.	10100.	925.	5040.	10500.	ANDREW OFF SB
LB9B	0.	4608.	9600.	0.	0.	0.	0.	0.	0.	ANDREW OFF NB
RB10A	455.	6624.	13800.	814.	8256.	17200.	1073.	7968.	16600.	S STA OFF MASS PI
RB10C	455.	6624.	13800.	814.	8256.	17200.	1073.	7968.	16600.	S STA OFF MASS PI
RB11A	1625.	9672.	20150.	1702.	11664.	24300.	1850.	12528.	26100.	MASS PIKE
RB11B	415.	8784.	18300.	518.	11664.	24300.	444.	12528.	26100.	MASS PIKE
RB11C	700.	8784.	18300.	703.	7296.	15200.	629.	8784.	18300.	MASS PIKE
RB12A	2761.	12672.	26400.	2349.	13920.	29000.	3515.	12864.	26800.	MASS PIKE
RB12B	1431.	5712.	11900.	1628.	7872.	16400.	2553.	240.	500.	MASS PIKE
RB12C	1431.	5712.	11900.	1628.	8832.	18400.	2553.	8736.	18200.	MASS PIKE
RB13A	3259.	18768.	39100.	3626.	13008.	27100.	3552.	13200.	27500.	MASS PIKE
RB13B	700.	4284.	8925.	1776.	9408.	19600.	1110.	9216.	19200.	MASS PIKE
RB13C	1749.	12168.	25350.	1776.	9408.	19600.	1110.	9216.	19200.	MASS PIKE
RB15A	1330.	6960.	14500.	1221.	6048.	12600.	962.	12624.	26300.	OFF NB KNEEL
RB15B	1330.	6960.	14500.	1221.	6048.	12600.	962.	12624.	26300.	OFF NB KNEEL
RB16A	1705.	8904.	18550.	1369.	9984.	20800.	1443.	10368.	21600.	FANUEIL SB OFF
RB17A	1885.	11928.	24850.	1739.	10560.	22000.	1665.	10080.	21000.	FANUEIL SB ON
RB18A	1100.	12528.	26100.	1628.	11616.	24200.	1665.	11472.	23900.	N STA SB

TABLE 1 (CONT'D.)

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
PB18B	1100.	12528.	26100.	1628.	11616.	24200.	1665.	11472.	23900.	N STA SB
PB19A	1820.	10656.	22200.	999.	12240.	25500.	962.	12528.	26100.	N STA NB
PB20A	190.	1824.	3800.	1406.	5424.	11300.	1628.	5568.	11600.	NB 95
PB21A	1325.	9086.	18929.	1221.	6144.	12800.	1147.	6816.	14200.	STORROW WB
PB21B	1325.	9086.	18929.	1221.	6144.	12800.	1147.	6816.	14200.	STORROW WB
PB22A	473.	3243.	6757.	296.	4080.	8500.	259.	4032.	8400.	STORROW WB
PB22B	473.	3243.	6757.	296.	4080.	8500.	259.	4032.	8400.	STORROW WB
PB23A	918.	6295.	13114.	740.	5760.	12000.	259.	5520.	11500.	STORROW EB
PB24A	1103.	7515.	15657.	916.	6278.	13080.	938.	6432.	13400.	STORROW WB
PB26A	770.	8496.	17700.	1221.	0.	0.	1295.	0.	0.	COLUMBIA NB
PB27A	732.	5366.	11180.	1406.	0.	0.	1406.	0.	0.	COLUMBIA NB
PB28A	202.	6768.	14100.	1332.	1488.	3100.	1628.	1968.	4100.	
PB29A	1210.	5880.	12250.	1164.	5856.	12200.	1406.	5712.	11900.	
PB29B	1210.	5880.	12250.	1164.	5856.	12200.	1406.	5712.	11900.	
PB30A	2559.	14484.	30175.	2220.	7584.	15800.	962.	6240.	13000.	
PB31A	1505.	10848.	22600.	2109.	12336.	25700.	1702.	13200.	27500.	
PB32A	630.	6264.	13050.	1221.	5760.	12000.	1147.	6432.	13400.	

TABLE 1

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB4A	1458.	8996.	17300.	2163.	11336.	21800.	7406.	13208.	25400.	CONGRESS
LB4D	1036.	4472.	8600.	1116.	4160.	8000.	444.	4264.	8200.	MARTHA
LB4E	668.	4472.	8600.	719.	3900.	7500.	481.	4108.	7900.	LOMASNEY
LB7C	1522.	11306.	21743.	2183.	14040.	27000.	2373.	14404.	27700.	STU/KNEEL
LB9A	1516.	11262.	21657.	1739.	9880.	19000.	1850.	10504.	20200.	SUDBURY
LB12A	850.	6314.	12143.	915.	2028.	3900.	740.	4160.	8000.	PORTL/NASHUA
LB12BB	1752.	14300.	27500.	1887.	4732.	9100.	1739.	6292.	12100.	PORTL/NASHUA
LB12B	1707.	11011.	21175.	1839.	4732.	9100.	1073.	6292.	12100.	PORTL/NASHUA
LB12C	2788.	18772.	36100.	3003.	10400.	20000.	2183.	11336.	21800.	PORTL/NASHUA
LB12D	2788.	18772.	36100.	3003.	10400.	20000.	2183.	11336.	21800.	PORTL/NASHUA
LB13A	2478.	17940.	34500.	2664.	26260.	50500.	3071.	27352.	52600.	C RIVER DAM
LB15A	2085.	10270.	19750.	1998.	14248.	27400.	2146.	14040.	27000.	N WASH/CH BR
LB15B	3813.	19136.	36800.	5217.	23712.	45600.	5918.	25584.	49200.	N WASH/CH BR
LB16A	721.	5356.	10300.	1007.	7384.	14200.	1184.	7488.	14400.	ATLANTIC
LB16B	969.	5512.	10600.	1850.	10556.	20300.	2257.	10764.	20700.	ATLANTIC
LB16C	1769.	7618.	14650.	1739.	9360.	18000.	2294.	9620.	18500.	ATLANTIC
LB16D	2128.	11180.	21500.	2516.	12168.	23400.	2294.	13364.	25700.	ATLANTIC
LB17A	1263.	9382.	18043.	1110.	10400.	20000.	1443.	13416.	25800.	NORTH
LB17B	1926.	14307.	27514.	1998.	11076.	21300.	3686.	11544.	22200.	NORTH
LB17C	2847.	20956.	40300.	2737.	22672.	43600.	4070.	24544.	47200.	NORTH
LB18A	1684.	7332.	14100.	1826.	12688.	24400.	2182.	13312.	25600.	HERALD
LB19A	6028.	43680.	84000.	6956.	44772.	86100.	7141.	47112.	90600.	STORROW SB
LB19B	7913.	45719.	87922.	6808.	53716.	103300.	7474.	55900.	107500.	STORROW SB
LB19C	7913.	45719.	87922.	6808.	51948.	99900.	7474.	54132.	104100.	STORROW SB
LB19D	6995.	40415.	77722.	6068.	43316.	83300.	7474.	44980.	86500.	STORROW SB
LB19E	6143.	35493.	68256.	4662.	43316.	83300.	4921.	44980.	86500.	STORROW SB
LB19F	6143.	35493.	68256.	4662.	36660.	70500.	4921.	37596.	72300.	STORROW SB
LB19G	7207.	47554.	91450.	6253.	56888.	109400.	7030.	53144.	102200.	STORROW SB
LB19H	7207.	47554.	91450.	6253.	56888.	109400.	7030.	53144.	102200.	STORROW SB
LB19I	2621.	20202.	38850.	2627.	25896.	49800.	2627.	26000.	50000.	STORROW SB
LB19J	5770.	48932.	94100.	5254.	24388.	46900.	5180.	50960.	98000.	STORROW 2WAY
LB20H	2850.	23816.	45800.	2627.	24492.	47100.	2553.	24960.	48000.	STORROW NB
LB21A	2120.	15749.	30286.	2473.	12220.	23500.	2405.	9048.	17400.	ARTERY
LB21B	1101.	8179.	15729.	1591.	13572.	26100.	1887.	12532.	24100.	ARTERY

TABLE 1 (CONT'D.)

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB22A	405.	3009.	5786.	725.	572.	1100.	955.	4680.	9000.	SOUTH
LB23A	826.	572.	1100.	1184.	4940.	9500.	1295.	3952.	7600.	W 4TH
LB24A	959.	5031.	9675.	2664.	11492.	22100.	2590.	10712.	20600.	ALBANY
LB24B	959.	5031.	9675.	2664.	6968.	13400.	2590.	6552.	12600.	ALBANY
LB24C	2141.	7696.	14800.	2664.	8684.	16700.	2405.	7852.	15100.	ALBANY
LB24D	1727.	12688.	24400.	3996.	7020.	13500.	3256.	6448.	12400.	ALBANY
LB25A	1742.	12941.	24886.	1079.	8944.	17200.	1554.	8736.	16800.	PURCHASE
LB25B	1742.	12941.	24886.	1079.	13624.	26200.	1554.	13416.	25800.	PURCHASE
LB25C	2642.	19626.	37743.	2374.	11024.	21200.	2442.	10608.	20400.	PURCHASE
LB26A	950.	7383.	13571.	1480.	9846.	18100.	1887.	10227.	18800.	BLACKSTONE
LB26B	228.	1772.	3257.	1460.	12077.	22200.	1628.	11696.	21500.	BLACKSTONE
LB29A	2190.	14040.	27000.	3848.	17576.	33800.	4329.	19240.	37000.	RUTHERFORD W
LB29BB	2190.	14040.	27000.	3848.	17576.	33800.	4329.	19240.	37000.	RUTHERFORD
LB31A	2639.	22100.	42500.	2812.	20696.	39800.	3258.	23192.	44600.	SUMNER TUNNEL
LB31B	3375.	25071.	48214.	3515.	25740.	49500.	3674.	28184.	54200.	SUMNER TUNNEL

TABLE 1

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS1A	1129.	6344.	12200.	944.	7189.	13825.	981.	7358.	14150.	SUMMER
LS1B	1721.	7722.	14850.	1691.	10556.	20300.	1628.	10790.	20750.	SUMMER
LS1C	1721.	11388.	21900.	2405.	10556.	20300.	2442.	10790.	20750.	SUMMER
LS1D	1690.	11804.	22700.	2445.	16198.	31150.	2516.	16692.	32100.	SUMMER
LS1E	1690.	11804.	22700.	2445.	16198.	31150.	2516.	16692.	32100.	SUMMER
LS1F	1915.	14222.	27350.	2720.	18447.	35475.	2794.	18954.	36450.	SUMMER
LS1G	1326.	10556.	20300.	1998.	18447.	35475.	2257.	18954.	36450.	SUMMER
LS2A	376.	2720.	5000.	254.	2475.	4550.	259.	2611.	4800.	E 1ST
LS2B	376.	2258.	4150.	499.	2747.	5050.	499.	2679.	4925.	W 1ST
LS3A	750.	5549.	10200.	778.	4597.	8450.	778.	4706.	8650.	E BROAD
LS3B	750.	5549.	10200.	1054.	7276.	13375.	1129.	7643.	14050.	W BROAD
LS3C	2624.	11206.	20600.	2091.	7276.	13375.	2238.	7643.	14050.	W BROAD
LS4A	1418.	10036.	19300.	1425.	10478.	20150.	1462.	10790.	20750.	COL/DAY
LS4B	1418.	10036.	19300.	1425.	10478.	20150.	1462.	10790.	20750.	COL/DAY
LS4C	1418.	10036.	19300.	548.	10478.	20150.	629.	10790.	20750.	COL/DAY
LS4D	322.	3042.	5850.	548.	9256.	17800.	629.	9607.	18475.	SOUTH
LS4E	423.	4264.	8200.	1425.	9256.	17800.	1499.	9607.	18475.	SOUTH
LS5A	1398.	7020.	13500.	1739.	13455.	25875.	2183.	14222.	27350.	COL/OLD COL
LS5B	1448.	11310.	21750.	1739.	13455.	25875.	2183.	14222.	27350.	OLD COL
LS5C	1902.	13052.	25100.	2128.	14404.	27700.	2534.	15184.	29200.	OLD COL
LS5D	1506.	10660.	20500.	1679.	14404.	27700.	1998.	15184.	29200.	OLD COL
LS6A	1490.	7176.	13800.	1832.	11726.	22550.	1942.	12376.	23800.	DAY
LS7A	844.	5954.	11450.	841.	6760.	13000.	883.	7306.	14050.	BOST/DORCH
LS7B	746.	5512.	10600.	1091.	6760.	13000.	1165.	7306.	14050.	BOST/DORCH
LS7C	2124.	12194.	23450.	2145.	13234.	25450.	2479.	13338.	25650.	BOST/DORCH
LS7D	1570.	8450.	16250.	1460.	13234.	25450.	1615.	13338.	25650.	BOST/DORCH
LS7E	1332.	7176.	13800.	1090.	7784.	14970.	1185.	7852.	15100.	BOST/DORCH
LS7F	868.	2990.	5750.	705.	3245.	6240.	731.	3271.	6290.	BOST/DORCH
LS8A	268.	1924.	3700.	156.	5512.	10600.	188.	5720.	11000.	D ST
LS8B	608.	4290.	8250.	722.	5512.	10600.	722.	5720.	11000.	D ST
LS8C	587.	3796.	7300.	870.	5512.	10600.	870.	5720.	11000.	D ST
LS8D	659.	3380.	6500.	870.	5161.	9925.	870.	5668.	10900.	D ST
LS8E	612.	4546.	8743.	706.	5161.	9925.	713.	5668.	10900.	D ST
LS10A	573.	4576.	8800.	610.	3770.	7250.	665.	3822.	7350.	A ST

TABLE 1 (CONT'D.)

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS10B	914.	6227.	11975.	610.	7605.	14625.	665.	8125.	15625.	A ST
LS10C	1160.	7501.	14425.	1128.	7605.	14625.	1184.	8125.	15625.	A ST
LS11A	764.	4732.	9100.	1067.	6609.	12710.	1084.	6713.	12910.	VIADUCT
LS12A	208.	1222.	2350.	291.	1706.	3280.	295.	1732.	3330.	B ST NE
LS14A	904.	5382.	10350.	1147.	8554.	16450.	1165.	8424.	16200.	NORTHERN
LS14B	1042.	6292.	12100.	1147.	15730.	30250.	1366.	16822.	32350.	NORTHERN
LS14C	1577.	9386.	18050.	2220.	15730.	30250.	2257.	16822.	32350.	NORTHERN
LS15A	231.	1764.	3500.	615.	7333.	14550.	647.	7637.	15550.	CONGRESS
LS15B	985.	4862.	9350.	1590.	7566.	14550.	1967.	8086.	15550.	CONGRESS
LS15C	839.	4862.	9350.	2366.	7566.	14550.	1721.	8086.	15550.	CONGRESS
LS17A	515.	3629.	7200.	752.	338.	670.	770.	343.	680.	METCHER
LS18A	144.	975.	1875.	233.	1885.	3625.	256.	1885.	3625.	W 2ND
LS18B	354.	1781.	3425.	352.	1885.	3625.	388.	1885.	3625.	W 2ND

TABLE 1

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE2A	126.	858.	1650.	125.	858.	1650.	126.	858.	1650.	JEFFRIES
LE3A	306.	2184.	4200.	296.	2236.	4300.	296.	2340.	4500.	MAVERICK
LE3B	361.	2262.	4350.	391.	2236.	4300.	391.	2340.	4500.	MAVERICK
LE3C	374.	2574.	4950.	404.	2236.	4300.	404.	2340.	4500.	MAVERICK
LE3D	633.	4394.	8450.	651.	2236.	4300.	679.	2340.	4500.	MAVERICK
LE4A	234.	1248.	2400.	222.	1300.	2500.	222.	1404.	2700.	SUMNER
LE4B	475.	2600.	5000.	475.	1300.	2500.	475.	1404.	2700.	SUMNER
LE4C	436.	2600.	5000.	435.	1300.	2500.	436.	1404.	2700.	SUMNER
LE4D	387.	2782.	5350.	387.	1300.	2500.	387.	1404.	2700.	SUMNER
LE5A	78.	302.	600.	67.	302.	600.	67.	302.	600.	COTTAGE
LE5B	67.	252.	500.	67.	252.	500.	67.	252.	500.	COTTAGE
LE6A	171.	932.	1850.	171.	932.	1850.	171.	932.	1850.	ORLEANS
LE6B	132.	857.	1700.	114.	726.	1440.	114.	726.	1440.	ORLEANS
LE7A	122.	1040.	2000.	122.	1586.	3050.	122.	1586.	3050.	BREMEN
LE7B	454.	1586.	3050.	403.	1586.	3050.	403.	1586.	3050.	BREMEN
LE7C	449.	4420.	8500.	463.	6084.	11700.	531.	6292.	12100.	BREMEN
LE7D	395.	5954.	11450.	469.	6084.	11700.	543.	6292.	12100.	BREMEN
LE7E	189.	2145.	4125.	224.	2189.	4210.	261.	2272.	4370.	BREMEN
LE8A	333.	2938.	5650.	333.	2938.	5650.	333.	2938.	5650.	CHELSEA
LE8B	312.	1898.	3650.	352.	1898.	3650.	389.	1898.	3650.	CHELSEA
LE8C	663.	4550.	8750.	777.	6734.	12950.	888.	6942.	13350.	CHELSEA
LE8D	760.	8255.	15875.	765.	7644.	14700.	896.	8320.	16000.	CHELSEA
LE8E	1086.	8112.	15600.	970.	76440.	147000.	981.	83200.	160000.	CHELSEA
LE8F	744.	6890.	13250.	962.	7644.	14700.	1147.	8320.	16000.	CHELSEA
LE9A	385.	2340.	4500.	403.	2371.	4560.	412.	2387.	4590.	MERIDIAN
LE9B	858.	8320.	16000.	351.	8424.	16200.	888.	8476.	16300.	MERIDIAN
LE9C	897.	7147.	13745.	999.	6968.	13400.	1055.	7540.	14500.	MERIDIAN
LE9D	815.	6404.	12315.	868.	6968.	13400.	962.	7540.	14500.	MERIDIAN
LE12A	547.	4368.	8400.	555.	4420.	8500.	555.	4472.	8600.	BENNINGTON
LE12B	836.	5876.	11300.	851.	5928.	11400.	888.	5980.	11500.	BENNINGTON
LE12C	1114.	9945.	19125.	1776.	13052.	25100.	1850.	13728.	26400.	BENNINGTON
LE13A	60.	806.	1600.	74.	306.	1600.	74.	806.	1600.	SARATOGA
LE13B	146.	1159.	2300.	148.	1159.	2300.	148.	1159.	2300.	SARATOGA
LE13C	503.	4876.	9675.	510.	4944.	9810.	510.	4944.	9810.	SARATOGA

TABLE 1 (CONT'D.)

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE13D	684.	6854.	13600.	693.	4133.	8200.	693.	4385.	8700.	SARATOGA
LE14B	175.	1159.	2300.	222.	1260.	2500.	259.	1361.	2700.	MARION
LE15A	419.	2270.	4365.	461.	2392.	4600.	518.	2548.	4900.	CONDOR
LE15B	419.	2270.	4365.	461.	2392.	4600.	518.	2548.	4900.	CONDOR
LE16A	569.	3458.	6650.	596.	2392.	4600.	625.	2548.	4900.	E EAGLE
LE17A	352.	2243.	4450.	398.	2535.	5030.	440.	2802.	5560.	HAVRE
LE17B	41.	295.	586.	46.	333.	660.	51.	368.	730.	HAVRE
LE18A	414.	3146.	6050.	461.	3640.	7000.	555.	4160.	8000.	PORTER SB
LE18B	422.	988.	1900.	963.	3640.	7000.	573.	4160.	8000.	PORTER SB
LE18C	732.	3497.	6725.	371.	1274.	2450.	1019.	2418.	4650.	PORTER SB
LE18D	661.	3653.	7025.	314.	5200.	10000.	962.	6084.	11700.	PORTER NB
LE18E	658.	8177.	15725.	1500.	18668.	35900.	895.	11175.	21490.	PORTER NB
LE18F	525.	3939.	7575.	1197.	8996.	17300.	714.	5356.	10300.	PORTER NB
LE19A	1270.	10400.	20000.	1350.	18460.	35500.	2109.	22204.	42700.	ACCESS
LE19B	1863.	15314.	29450.	2516.	18356.	35300.	2960.	22204.	42700.	ACCESS
LE19C	2155.	16009.	30766.	2292.	17004.	32700.	3341.	24804.	47700.	ACCESS
LE19D	2070.	15377.	29571.	2429.	18044.	34700.	3294.	24492.	47100.	ACCESS
LE19E	2070.	15377.	29571.	2429.	18044.	34700.	3294.	24492.	47100.	ACCESS
LE19F	2070.	15377.	29571.	2429.	18044.	34700.	3294.	24492.	47100.	ACCESS
LE19G	1990.	14783.	28429.	2565.	19032.	36600.	3247.	24128.	46400.	ACCESS
LE19H	1823.	13520.	26000.	2369.	16692.	32100.	2997.	20800.	40000.	ACCESS
LE19I	916.	4368.	8400.	962.	5980.	11500.	1221.	5200.	10000.	RAMP ON
LE19J	847.	8710.	16750.	1406.	10400.	20000.	1776.	12480.	24000.	RAMP ON
LE19K	533.	4472.	8600.	566.	5772.	11100.	851.	7124.	13700.	RAMP OFF
LE20A	477.	5408.	10400.	1420.	16120.	31000.	1777.	20124.	38700.	SERVICE RD
LE20B	1160.	8617.	16571.	1014.	7540.	14500.	1273.	9464.	18200.	SERVICE RD
LE20C	879.	4394.	8450.	1138.	5668.	10900.	1437.	7176.	13800.	SERVICE RD
LE20D	580.	4309.	8286.	565.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20E	505.	2834.	5450.	565.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20F	505.	2834.	5450.	565.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20G	505.	2834.	5450.	565.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20H	562.	3822.	7350.	565.	3380.	6500.	777.	39000.	75000.	SERVICE RD
LE20I	562.	4628.	8900.	565.	5148.	9900.	777.	5668.	10900.	SERVICE RD
LE20J	967.	6162.	11850.	565.	5148.	9900.	777.	5668.	10900.	SERVICE RD
LE21A	2847.	20956.	40300.	2626.	22516.	43300.	3922.	24544.	47200.	TUNNEL NB 1A

TABLE 1 (CONT'D.)

TRAFFIC VOLUMES FOR NO-BUILD ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE21B	2847.	19344.	40300.	3626.	20784.	43300.	3922.	22656.	47200.	TUNNEL NB 1A
LE21C	2579.	17328.	36100.	3320.	18528.	38600.	3589.	19680.	41000.	TUNNEL NB 1A
LE21D	1309.	7728.	16100.	1460.	6912.	14400.	1480.	8640.	18000.	TUNNEL NB 1A
LE21E	1309.	7728.	16100.	1460.	6912.	14400.	1480.	8640.	18000.	TUNNEL NB 1A
LE21F	2225.	11760.	24500.	2442.	12432.	25900.	2701.	13440.	28000.	TUNNEL NB 1A
LE22A	2639.	22100.	42500.	2312.	22516.	43300.	3182.	24700.	47500.	TUNNEL NB 1A
LE22B	1902.	14424.	30050.	1776.	20784.	43300.	2072.	22800.	47500.	TUNNEL NB 1A
LE22C	1930.	14424.	30050.	1776.	14784.	30800.	2072.	16560.	34500.	TUNNEL NB 1A
LE22D	1930.	14424.	30050.	1776.	14784.	30800.	2072.	16560.	34500.	TUNNEL NB 1A
LE22E	1930.	14424.	30050.	1776.	14784.	30800.	2072.	16560.	34500.	TUNNEL NB 1A
LE22F	1616.	10512.	21900.	1036.	10224.	21300.	1147.	16416.	34200.	TUNNEL NB 1A
LE22G	1616.	10512.	21900.	1036.	10224.	21300.	1147.	16416.	34200.	TUNNEL NB 1A
LE23A	3841.	22272.	46400.	3478.	22656.	47200.	3848.	25056.	52200.	TUNNEL NB 1A
LE23AA	2255.	14796.	30825.	2590.	19968.	41600.	2923.	22080.	46000.	TUNNEL NB 1A

TABLE 2

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
NX1	8198.	64042.	133420.	12249.	72864.	151800.	13209.	74640.	155500.	XWAY 2WAY
NX3	9700.	77904.	162300.	14913.	81312.	169400.	15873.	84672.	176400.	XWAY 2WAY
NX5	9550.	70968.	147850.	14876.	80928.	168600.	15836.	84240.	175500.	XWAY 2WAY
NX7	10350.	78312.	163150.	15133.	77040.	160500.	15947.	81168.	169100.	XWAY NB
NX11	2500.	27456.	57200.	5032.	30720.	64000.	5069.	32736.	68200.	XWAY NB
NX13A	8450.	73776.	153700.	15318.	86592.	180400.	15947.	89808.	187100.	XWAY 2WAY
NX13B	6553.	66288.	138100.	6845.	37200.	77500.	6734.	37632.	78400.	XWAY 2WAY
NX15	5189.	53280.	111000.	5550.	30336.	63200.	5439.	30288.	63100.	XWAY NB
NX19	6532.	69024.	143800.	5698.	43824.	91300.	5661.	44976.	93700.	XWAY NB
NX21	6262.	69720.	145250.	5698.	43824.	91300.	5661.	44976.	93700.	XWAY NB
NX23	6262.	69720.	145250.	6501.	50880.	106000.	6660.	48000.	100000.	XWAY NB
NX25	7602.	78960.	164500.	7946.	56736.	118200.	8140.	58704.	122300.	XWAY NB
NX27	7602.	78960.	164500.	12316.	95520.	199000.	12506.	90192.	187900.	XWAY NB
NX29	7602.	78960.	164500.	10584.	76080.	158500.	10693.	78912.	164400.	XWAY NB
NX31	8042.	77616.	161700.	10584.	76080.	158500.	10693.	78912.	164400.	XWAY NB
NX33	8042.	77616.	161700.	10989.	83952.	174900.	11507.	88944.	185300.	XWAY 2WAY
NX35	5347.	34008.	70850.	6027.	37680.	78500.	6142.	38880.	81000.	1WAY NB
NX35A	3347.	22680.	47250.	3700.	26016.	54200.	3737.	27552.	57400.	1WAY NB
NX37	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX41	1750.	14256.	29700.	0.	0.	0.	0.	0.	0.	1WAY SB
NX43	2180.	17088.	35600.	1998.	15168.	31600.	2109.	16368.	34100.	1WAY
NX45	2180.	17088.	35600.	1998.	15168.	31600.	2109.	16368.	34100.	1WAY SB
NX49	5295.	34800.	72500.	5291.	28560.	59500.	5587.	30576.	63700.	XWAY 2WAY
NX51	5295.	34800.	72500.	5291.	28560.	59500.	5587.	30576.	63700.	XWAY 2WAY
NX53	5260.	34176.	71200.	6660.	46656.	97200.	7215.	49152.	102400.	MASS PIKE
NX55	5260.	34176.	71200.	6660.	46656.	97200.	7215.	49152.	102400.	MASS PIKE
NX59	1953.	14712.	30650.	0.	0.	0.	0.	0.	0.	CITY SQ
NX61	3115.	17712.	36900.	3293.	13392.	27900.	3478.	14208.	29600.	CITY SQ
SX8	5250.	38736.	80700.	8510.	41472.	86400.	8880.	42432.	88400.	1WAY SB
SX10	5250.	38736.	80700.	8510.	41472.	86400.	8880.	42432.	88400.	1WAY SB
SX30A	3710.	34200.	71250.	5180.	45456.	94700.	5365.	47472.	98900.	1WAY SB
SX30B	1890.	23544.	49050.	3478.	29424.	61300.	3515.	31632.	65900.	1WAY SB
SX32	2150.	21768.	45350.	2886.	25584.	53300.	3071.	26160.	54500.	93
SX32A	5354.	39240.	81750.	11207.	83136.	173200.	11507.	86352.	179900.	93

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
SX38	895.	1872.	3900.	444.	3696.	7700.	518.	3792.	7900.	93
SX42	4289.	21168.	44100.	5106.	25872.	53900.	5217.	27072.	56400.	93
SX44	6439.	42936.	89450.	8695.	53664.	111800.	9065.	56400.	117500.	93
SX46	6439.	42936.	89450.	8695.	53664.	111800.	9065.	56400.	117500.	93
NX70	0.	71520.	149000.	666.	2208.	4600.	777.	3168.	6600.	93 OFF SB -US1NB
NX71	0.	0.	0.	1924.	16320.	34000.	1961.	16464.	34300.	93 OFF NB TO US1NB
NX72	0.	0.	0.	2590.	18528.	38600.	2738.	19632.	40900.	93 CONNECT 93S-US1N
NX73	0.	0.	0.	2590.	18528.	38600.	2738.	19632.	40900.	ON TO US1 NB
NX74	0.	0.	0.	1591.	11472.	23900.	1591.	12528.	26100.	OFF US1 SB TO 93SB
NX75	0.	0.	0.	2294.	19872.	41400.	2294.	21312.	44400.	CONNECT US1SB-93NB
NX76	0.	0.	0.	2294.	19872.	41400.	2294.	21312.	44400.	ON TO 93SB
X77	5189.	53280.	111000.	6364.	35856.	74700.	6512.	36864.	76800.	DEWEY SQ TUNNEL
X78	6532.	69024.	143800.	6623.	38880.	81000.	6808.	40464.	84300.	DEWEY SQ TUNNEL
X79	2639.	22100.	425000.	1591.	12288.	25600.	1998.	14208.	29600.	SUMNER TUNNEL
X80	2847.	20956.	403000.	2146.	13104.	27300.	2479.	15264.	31800.	CALLAHAN TUNNEL
X81	0.	0.	0.	740.	8544.	17800.	888.	10224.	21300.	HBR TUN TO PIKE: 5A
X82	0.	0.	0.	962.	13488.	28100.	1147.	14928.	31100.	PIKE TO NEW TUNNELS
X83	0.	0.	0.	1591.	8208.	17100.	1887.	8880.	18500.	HBR TUN TO CA SB:5A
X84	0.	0.	0.	1554.	9600.	20000.	1628.	9984.	20800.	SV RD /CA NB: 3A,5A
X85	0.	0.	0.	3811.	25344.	52800.	4070.	26352.	54900.	CTRL ART NB
X86	0.	0.	0.	4477.	32736.	68200.	5328.	38976.	81200.	NEW HBR TUN: 5A
X87	0.	0.	0.	4477.	32736.	68200.	5328.	38976.	81200.	NEW HBR TUN: 5A
X88	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 5A
X89	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 5A
X90	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 5A
X91	0.	0.	0.	4144.	30432.	63400.	4292.	31824.	66300.	CHANNEL TUN: 3A,6
X92	0.	0.	0.	4144.	30432.	63400.	4292.	31824.	66300.	CHANNEL TUN: 3A,6
X93	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 3A
X94	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 3A,5A
X95	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW HBR TUN: 3A,5A
X96	0.	0.	0.	0.	0.	0.	0.	0.	0.	1A TO NEW TUN:3A,5A
X97	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW TUN TO 1A:3A,5A
X98	0.	0.	0.	0.	0.	0.	0.	0.	0.	LOGAN TO TUN: 3A,5A
X99	0.	0.	0.	0.	0.	0.	0.	0.	0.	TUN TO LOGAN: 3A,5A
X100	0.	0.	0.	3811.	28512.	59400.	4255.	29472.	61400.	LEV CIR/XWAY TUN

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFFERED ALTERNATIVE - EXPRESSWAY

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
X101	0.	0.	0.	3552.	25728.	53600.	3943.	29520.	61500.	NEW TUN S BOS SB.C
X102	0.	0.	0.	3552.	25728.	53600.	3943.	29520.	61500.	NEW TUN OPEN DEP
X103	0.	0.	0.	3996.	28224.	58800.	4656.	32400.	67500.	NEW TUN S BOS SB.C
X104	0.	0.	0.	3848.	24768.	51600.	4662.	28944.	60300.	NEW TUN PLAZA SB.C
X105	0.	0.	0.	3848.	28080.	58500.	4662.	32832.	68400.	NEW TUN S BOS SB.C
X106	0.	0.	0.	3848.	28080.	58500.	4662.	32832.	68400.	NEW TUN X HBR SB.C
X107	0.	0.	0.	3848.	28080.	58500.	4662.	32832.	68400.	NEW TUN BIF SB.C
X108	0.	0.	0.	3848.	28080.	58500.	4662.	32832.	68400.	NEW TUN BIF SB.C

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
RB1A	852.	10656.	22200.	0.	0.	0.	0.	0.	0.	LEV CIRC/XWAY SB
RB1B	852.	10656.	22200.	0.	0.	0.	0.	0.	0.	LEV CIRC/XWAY SB
RB2A	2000.	11328.	23600.	1258.	7008.	14600.	1036.	6960.	14500.	LEV CIRC/XWAY NB
RB3A	493.	5736.	11950.	370.	4752.	9900.	586.	3504.	7300.	ACC/XWAY NB
RB3B	1703.	12360.	25750.	1147.	12288.	25600.	1517.	11952.	24900.	ACC/XWAY NB
RB3D	1703.	12360.	25750.	1036.	10656.	22200.	1406.	10656.	22200.	ACC/XWAY NB
RB3E	2568.	14376.	29950.	1961.	13008.	27100.	2257.	13056.	27200.	ACC/XWAT NB
RB3F	368.	2376.	4950.	962.	6240.	13000.	1073.	5952.	12400.	ACC/XWAY NB
RB4A	500.	4416.	9200.	666.	6432.	13400.	555.	6624.	13800.	MASS/OFF SB
RB5A	900.	1776.	3700.	518.	1920.	4000.	666.	2448.	5100.	MASS/ON SB
RB5B	900.	1776.	3700.	518.	1920.	4000.	666.	2448.	5100.	MASS/ON SB
RB6A	200.	3168.	6600.	962.	6288.	13100.	1332.	6144.	12800.	MASS/ON NB
RB7A	500.	3720.	7750.	999.	3168.	6600.	1332.	3072.	6400.	MASS/OFF NB
RB7B	500.	3720.	7750.	999.	3168.	6600.	1332.	3072.	6400.	MASS/OFF NB
RB8A	150.	2328.	4850.	37.	384.	800.	37.	432.	900.	ANDREW OFF NB
RB8B	150.	2328.	4850.	37.	384.	800.	37.	432.	900.	ANDREW OFF NB
RB9A	800.	7344.	15300.	999.	4944.	10300.	1073.	5328.	11100.	ANDREW OFF SB
RB9B	0.	4608.	9600.	0.	0.	0.	0.	0.	0.	ANDREW OFF NB
RB10A	455.	6624.	13800.	740.	5280.	11000.	850.	6048.	12600.	S STA OFF MASS PI
RB10C	455.	6624.	13800.	0.	0.	0.	0.	0.	0.	S STA OFF MASS PI
RB11A	1625.	9672.	20150.	1073.	4896.	10200.	1073.	4896.	10200.	MASS PIKE
RB11B	415.	8784.	18300.	1073.	4896.	10200.	1073.	4896.	10200.	MASS PIKE
RB11C	700.	8784.	18300.	0.	0.	0.	0.	0.	0.	MASS PIKE
RB12A	2761.	12672.	26400.	0.	0.	0.	0.	0.	0.	MASS PIKE
RB12B	1431.	5712.	11900.	0.	0.	0.	0.	0.	0.	MASS PIKE
RB12C	1431.	5712.	11900.	0.	0.	0.	0.	0.	0.	MASS PIKE
RB13A	3259.	18768.	39100.	1468.	6288.	13100.	1591.	6816.	14200.	MASS PIKE
RB13B	700.	4284.	8925.	2356.	4320.	9000.	2553.	4704.	9800.	MASS PIKE
RB13C	1749.	12168.	25350.	1332.	7824.	16300.	1295.	7584.	15800.	MASS PIKE
RB15A	1330.	6960.	14500.	0.	0.	0.	0.	0.	0.	OFF NB KNEEL
RB15B	1330.	6960.	14500.	0.	0.	0.	0.	0.	0.	OFF NB KNEEL
RB16A	1705.	8904.	18550.	1036.	7296.	15200.	1258.	8736.	18200.	XWAY SB TO CALH
RB17A	1885.	11928.	24850.	1813.	7392.	15400.	1889.	7776.	16200.	FANUEIL SB ON
RB18A	1100.	12528.	26100.	0.	0.	0.	0.	0.	0.	N STA SB

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
RB18B	1100.	12528.	26100.	0.	0.	0.	0.	0.	0.	N STA SB
RB19A	1820.	10656.	22200.	1702.	15984.	33300.	1850.	15840.	33000.	N STA NB
RB20A	190.	1824.	3800.	0.	0.	0.	0.	0.	0.	NB 95
RB21A	1325.	9086.	18929.	1036.	6096.	12700.	1110.	6288.	13100.	STORROW WB
RB21B	1325.	9086.	18929.	1036.	6096.	12700.	1110.	6288.	13100.	STORROW WB
RB22A	473.	3243.	6757.	703.	4944.	10300.	703.	5280.	11000.	STORROW WB
RB22B	473.	3243.	6757.	703.	4944.	10300.	703.	5280.	11000.	STORROW WB
RB23A	918.	6295.	13114.	592.	5040.	10500.	629.	5088.	10600.	STORROW EB
RB24A	1103.	7515.	15657.	481.	4992.	10400.	518.	5184.	10800.	STORROW WB
RB26A	770.	8496.	17700.	1295.	6816.	14200.	1295.	6912.	14400.	COLUMBIA NB
RB27A	732.	5366.	11180.	1369.	6576.	13700.	1369.	7200.	15000.	COLUMBIA NB
RB28A	202.	6768.	14100.	999.	1728.	3600.	962.	2496.	5200.	
RB29A	1210.	5880.	12250.	1079.	4752.	9900.	1147.	5088.	10600.	
RB29B	1210.	5880.	12250.	1079.	4752.	9900.	1147.	5088.	10600.	
RB30A	2559.	14484.	30175.	1813.	9888.	20600.	1850.	10080.	21000.	
RB31A	1505.	10848.	22600.	0.	0.	0.	0.	0.	0.	
RB32A	630.	6264.	13050.	0.	0.	0.	0.	0.	0.	
RB33	0.	0.	0.	1739.	4320.	9000.	1460.	4320.	9000.	NORTHERN TO XWAY
RB34	0.	0.	0.	962.	8064.	16800.	962.	8784.	18300.	XWAY SB TO SURF
RB35	0.	0.	0.	1702.	15552.	32400.	1998.	15984.	33300.	LEV CIR TO XWAY
RB36	0.	0.	0.	2109.	12960.	27000.	2257.	13776.	28700.	XWAY NB TO LEVT
NEB1	0.	0.	0.	0.	0.	0.	0.	0.	0.	NEW TUNNEL
NEB2	0.	0.	0.	0.	0.	0.	0.	0.	0.	AIRPT EXIT RD
NEB3	0.	0.	0.	0.	0.	0.	0.	0.	0.	SERVICE CONNCT
NEB4	0.	0.	0.	0.	0.	0.	0.	0.	0.	AIRPT RD CONNCT
NEB5	0.	0.	0.	0.	0.	0.	0.	0.	0.	CONNCT TO TUNN
NEB6	0.	0.	0.	0.	0.	0.	0.	0.	0.	
NEB7	0.	0.	0.	0.	0.	0.	0.	0.	0.	RP FROM EXIT RD
NEB8	0.	0.	0.	0.	0.	0.	0.	0.	0.	TO 1A
NEB9	0.	0.	0.	0.	0.	0.	0.	0.	0.	1A TO RP
NEB10	0.	0.	0.	0.	0.	0.	0.	0.	0.	CONNCT TO TUNN
NEB11	0.	0.	0.	375.	1144.	2200.	468.	1248.	2400.	SVC RD
NEB12	0.	0.	0.	2314.	14092.	27100.	3147.	16536.	31800.	LOGAN EXIT RD
NEB13	0.	0.	0.	3357.	24024.	46200.	4304.	26392.	54600.	LOGAN EXIT RD
NEB14	0.	0.	0.	781.	4212.	8100.	976.	4784.	9200.	CROSS RD

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
NEB15	0.	0.	0.	1570.	10296.	19800.	1949.	11700.	22500.	CROSS RD 5B,C
NEB16	0.	0.	0.	1963.	11128.	21400.	2284.	12584.	24200.	CROSS RD 5B,C
NEB17	0.	0.	0.	2591.	25116.	48300.	3411.	29640.	57000.	TERMINAL LOOP 5B,C
NEB18	0.	0.	0.	152.	468.	900.	175.	520.	1000.	PTR TO NEWTUN 5B,C
NEB19	0.	0.	0.	555.	4888.	9400.	814.	5408.	10400.	1A TO NEW TUN 5C
NEB20	0.	0.	0.	999.	9932.	19100.	1157.	11856.	22800.	LOGANTONEWTUN 5B,C
NEB21	0.	0.	0.	1026.	5200.	10000.	1184.	5200.	10000.	NEW TUN TO 1A 5C
NEB22	0.	0.	0.	322.	4680.	9000.	414.	5928.	11400.	NEWTUN TO BIF 5B,C
NEB23	0.	0.	0.	798.	5252.	10100.	918.	6656.	12800.	NEWTUNTOLOGAN 5B,C
NEB24	0.	0.	0.	322.	4680.	9000.	414.	5928.	11400.	NEWTUN TO BIF 5B,C
NEB25	0.	0.	0.	798.	5252.	10100.	918.	6656.	12800.	NEWTUNTOLOGAN 5B,C
NEB26	0.	0.	0.	1026.	5200.	10000.	1184.	5200.	10000.	NEW TUN TO 1A 5C
NEB27	0.	0.	0.	999.	9932.	19100.	1157.	11856.	22800.	LOGANTONEWTUN 5B,C
NEB28	0.	0.	0.	940.	10556.	20300.	1163.	12428.	23900.	BIF ACC LOOP 5B,C
NEB29	0.	0.	0.	1280.	9204.	17700.	1549.	10244.	19700.	BIF ACC LOOP 5B,C
NEB30	0.	0.	0.	448.	2236.	4300.	560.	2600.	5000.	RP TO SVC RD 5B,C
NEB31	0.	0.	0.	3340.	9152.	17600.	4331.	9984.	19200.	LOGAN TO 1A 5B,C
NSB1	0.	0.	0.	0.	0.	0.	0.	0.	0.	RP TO MASS PI
NSB2	0.	0.	0.	0.	0.	0.	0.	0.	0.	NB "CONNCTOR"
NSB3	0.	0.	0.	3441.	24432.	50900.	3737.	25440.	53000.	CENTRL ARTERY
NSB4	0.	0.	0.	962.	6240.	13000.	1073.	5952.	12400.	RAMP FRM SERV RD
NSB5	0.	0.	0.	962.	13488.	28100.	1147.	14928.	31100.	RP FRM MASS PI
NSB6	0.	0.	0.	0.	0.	0.	0.	0.	0.	DORCHESTER AVE
NSB7	0.	0.	0.	1036.	9568.	18400.	1221.	9568.	18400.	DORCHESTER AVE
NSB8	0.	0.	0.	1930.	8944.	17200.	2109.	9776.	18800.	DORCHESTER AVE
NSB9	0.	0.	0.	0.	0.	0.	0.	0.	0.	DORCHESTER AVE
NSB10	0.	0.	0.	0.	0.	0.	0.	0.	0.	RMP NEW CA/OLD
NSB11	0.	0.	0.	0.	0.	0.	0.	0.	0.	CONNCT NEW CA/OLD
NSB12	0.	0.	0.	0.	0.	0.	0.	0.	0.	3 LINKS SUMMER
NSB13	0.	0.	0.	0.	0.	0.	0.	0.	0.	TO CA NB
NSB14	0.	0.	0.	0.	0.	0.	0.	0.	0.	IN TUNNEL
NSB1V	0.	0.	0.	1258.	6240.	13000.	1406.	7200.	15000.	CON CHANL TO X*Y
NSB5V	0.	0.	0.	740.	8544.	17800.	888.	10224.	21300.	RMP FRM CONNLCTR
NSB20	0.	0.	0.	4477.	32736.	68200.	5328.	38976.	81200.	NEW TUN OPEN SEC
NSB21	0.	0.	0.	481.	3408.	7100.	518.	3072.	6400.	CONG TO TUNN SB

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - RAMPS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
NSB22	0.	0.	0.	148.	2928.	6100.	185.	2832.	5900.	TUN NB TO CONGR
NSB23	0.	0.	0.	1169.	12096.	25200.	1357.	12864.	26800.	CONGRSS TO NORTHN
NSB24	0.	0.	0.	444.	2400.	5000.	444.	2880.	6000.	CONG TO TUNN NB
NSB25	0.	0.	0.	444.	2400.	5000.	444.	2880.	6000.	CONG TO TUNN NB
NSB26	0.	0.	0.	333.	3264.	6800.	370.	3408.	7100.	TUNN SB TO CONG
NSB27	0.	0.	0.	333.	3264.	6800.	370.	3408.	7100.	TUNN SB TO CONG
NSB28	0.	0.	0.	296.	3600.	7500.	292.	3552.	7400.	EB OFF TO SUM/HAUL
NSB29	0.	0.	0.	185.	816.	1700.	185.	816.	1700.	HAUL RD TO TUN NB
NSB30	0.	0.	0.	296.	2160.	4500.	296.	2160.	4500.	SUMMER TO TUN NB
NSB31	0.	0.	0.	185.	2544.	5300.	185.	2544.	5300.	EB OFF TO SUMMER
NSB32	0.	0.	0.	74.	1296.	2700.	74.	1296.	2700.	EB OFF TO HAUL RD
NSB33	0.	0.	0.	159.	1061.	2210.	159.	1061.	2210.	MASSPORT HAUL RD
NSB34	0.	0.	0.	444.	6528.	13600.	444.	6384.	13300.	EB TO CONG/SUM/HAU
NSB35	0.	0.	0.	296.	3600.	7500.	292.	3552.	7400.	EB OFF TO SUM/HAUL
NSB36	0.	0.	0.	333.	3264.	6800.	370.	3408.	7100.	WB OFF TO CONG/NUR
NSB37	0.	0.	0.	481.	2976.	6200.	481.	2976.	6200.	ON WB FROM SUM/HAU
NSB38	0.	0.	0.	481.	2976.	6200.	481.	2976.	6200.	ON WB FROM SUM/HAU
NSB40	0.	0.	0.	0.	0.	0.	0.	0.	0.	KNIELAND E END
NSB41	0.	0.	0.	734.	5280.	11000.	844.	6048.	12600.	PIKE TO ATLANTIC
NSB42	0.	0.	0.	6.	44.	92.	6.	44.	92.	PIKE TO S STATION
NSB43	0.	0.	0.	740.	5280.	11000.	850.	6048.	12600.	PIKE TO ATL AV/S S
NSB44	0.	0.	0.	179.	397.	828.	179.	397.	828.	BUS:S.STA ACC RD
NSB45	0.	0.	0.	179.	397.	828.	179.	397.	828.	BUS:S.STA ACC RD
NSB46	0.	0.	0.	179.	397.	828.	179.	397.	828.	BUS:S.STA ACC RD
NSB47	0.	0.	0.	179.	397.	828.	179.	397.	828.	BUS:S.STA ACC RD
NSB48	0.	0.	0.	55.	159.	332.	55.	159.	332.	BUS:ACC RD/KNEELND
NSB49	0.	0.	0.	112.	216.	450.	112.	216.	450.	BUS:S.STA TO PIKE
NSB50	0.	0.	0.	25.	44.	92.	25.	44.	92.	BUS:S.STA TO PIKE
NSB51	0.	0.	0.	25.	44.	92.	25.	44.	92.	BUS:S.STA TO PIKE
NSB52	0.	0.	0.	25.	44.	92.	25.	44.	92.	BUS:S.STA TO PIKE
NSB53	0.	0.	0.	25.	44.	92.	25.	44.	92.	BUS:S.STA TO PIKE
NSB54	0.	0.	0.	25.	44.	92.	25.	44.	92.	BUS:S.STA TO PIKE
NSB55	0.	0.	0.	87.	172.	358.	87.	172.	358.	BUS:CA/TUN/S.STA
NSB56	0.	0.	0.	87.	172.	358.	87.	172.	358.	BUS:CA/TUN/S.STA
NSB57	0.	0.	0.	6.	22.	46.	6.	22.	46.	BUS:NEW TUN TO S.S
NSB58	0.	0.	0.	6.	22.	46.	6.	22.	46.	BUS:NEW TUN TO S.S
NSB59	0.	0.	0.	6.	22.	46.	6.	22.	46.	BUS:NEW TUN TO S.S
NSB60	0.	0.	0.	6.	22.	46.	6.	22.	46.	BUS:NEW TUN TO S.S
NSB61	0.	0.	0.	6.	22.	46.	6.	22.	46.	BUS:NEW TUN TO S.S
NSB62	0.	0.	0.	2738.	10608.	22100.	3034.	10560.	22000.	CA NB TO PIKE/KNEL
NSB63	0.	0.	0.	2812.	10608.	22100.	3034.	10560.	22000.	CA NB TO PIKE/KNLN
NSB64	0.	0.	0.	2812.	10608.	22100.	3034.	10560.	22000.	CA NB TO PIKE/KNLN
NSB65	0.	0.	0.	2812.	10608.	22100.	3034.	10560.	22000.	CA NB TO PIKE/KNLN
NSB66	0.	0.	0.	2812.	10608.	22100.	3034.	10560.	22000.	CA NB TO PILE/KNLN

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - RAMPS

NSB67	0.	0.	0.	740.	4512.	9400.	851.	4464.	9300.	CA NB TO KNEELAND
NSB68	0.	0.	0.	740.	4512.	9400.	851.	4464.	9300.	CA NB TO KNEELAND
NSB69	0.	0.	0.	740.	4512.	9400.	851.	4464.	9300.	CA NB TO KNEELAND
NSB70	0.	0.	0.	2072.	6096.	12700.	2183.	6096.	12700.	CA NB TO PIKE
NSB71	0.	0.	0.	2072.	6096.	12700.	2183.	6096.	12700.	CA NB TO PIKE
NSB72	0.	0.	0.	2072.	6096.	12700.	2183.	6096.	12700.	CA NB TO PIKE
NSB73	0.	0.	0.	3602.	15286.	28100.	3589.	15232.	28000.	HERALD EXT(BWY BR)
NSB74	0.	0.	0.	3240.	16810.	30900.	3293.	17085.	31406.	HERALD EXT(BWY BR)
NSB75	0.	0.	0.	3086.	19747.	36300.	3367.	21542.	39600.	HERALD EXT(BWY BR)
NSB76	0.	0.	0.	555.	7800.	15000.	555.	8424.	16200.	DORCHESTER AVE
NSB77	0.	0.	0.	555.	7800.	15000.	555.	8424.	16200.	DORCHESTER AVE
NSB78	0.	0.	0.	592.	6864.	14300.	703.	7392.	15400.	CA NB TI BWAY
NSB79	0.	0.	0.	333.	1968.	4100.	481.	1680.	3500.	NEW TUN SB TO BWAY
NSB80	0.	0.	0.	333.	1968.	4100.	481.	1680.	3500.	NEW TUN SB TO BWAY
NSB81	0.	0.	0.	333.	1968.	4100.	481.	1680.	3500.	NEW TUN SB TO BWAY
NSB82	0.	0.	0.	75.	150.	312.	75.	150.	312.	BUS:CA NB TO S.STA
NSB83	0.	0.	0.	12.	22.	46.	12.	22.	46.	BUS:S.STA TO NEW T
NSB84	0.	0.	0.	12.	22.	46.	12.	22.	46.	BUS:S.STA TO NEW TU
NSB85	0.	0.	0.	12.	22.	46.	12.	22.	46.	BUS:S.S. TO NEW TU
NSB86	0.	0.	0.	370.	912.	1900.	296.	912.	1900.	S.STA TO NEW TUN
NSB87	0.	0.	0.	925.	4224.	8800.	851.	4944.	10300.	BWY TO NEW TUNS
NSB88	0.	0.	0.	925.	4224.	8800.	851.	4944.	10300.	BWY TO NEW TUNS
NSB89	0.	0.	0.	555.	3312.	6900.	555.	4032.	8400.	BWY TO CHAN TUN
NSB90	0.	0.	0.	555.	3312.	6900.	555.	4032.	8400.	BWY TO CHAN TUN
NSB91	0.	0.	0.	370.	912.	1900.	296.	912.	1900.	BWY TO XHBR TUN
NSB92	0.	0.	0.	370.	912.	1900.	296.	912.	1900.	BWY TO XHBR TUN
NSB93	0.	0.	0.	370.	912.	1900.	296.	912.	1900.	BWY TI XHBR TUN
NSB94	0.	0.	0.	370.	912.	1900.	296.	912.	1900.	BWY TO XHBR TUN
NSB95	0.	0.	0.	370.	912.	1900.	296.	912.	1900.	BWY TO XHBR TUN
NSB96	0.	0.	0.	1776.	6336.	13200.	1554.	6096.	12700.	ONTO CA SB@BEACH
NSB97	0.	0.	0.	0.	0.	0.	0.	0.	0.	ONTO CA NB@ESSEX

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB4A	1458.	8996.	17300.	2072.	8112.	15600.	2035.	8892.	17100.	CONGRESS
LB4D	1036.	4472.	8600.	777.	4992.	9600.	777.	5148.	9900.	MARTHA
LB4E	668.	4472.	8600.	481.	2080.	4000.	555.	2496.	4800.	LOMASNEY
LB7C	1522.	11306.	21743.	888.	6396.	12300.	925.	7332.	14100.	STU/KNEEL
LB9A	1516.	11262.	21657.	2442.	12636.	24300.	2479.	12688.	24400.	SUDBURY
LB12A	850.	6314.	12143.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB12BB	1752.	14300.	27500.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB12B	1707.	11011.	21175.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB12C	2788.	18772.	36100.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB12D	2788.	18772.	36100.	0.	0.	0.	0.	0.	0.	PORTL/NASHUA
LB13A	2478.	17940.	34500.	2035.	26624.	51200.	2183.	28028.	53900.	C RIVER DAM
LB15A	2085.	10270.	19750.	2071.	13728.	26400.	2296.	13988.	26900.	N WASH/CH BR
LB15B	3813.	19136.	36800.	4575.	14404.	27700.	4995.	16796.	32300.	N WASH/CH BR
LB16A	721.	5356.	10300.	1073.	6240.	12000.	1184.	6656.	12800.	ATLANTIC
LB16B	969.	5512.	10600.	925.	4784.	9200.	962.	5096.	9800.	ATLANTIC
LB16C	1769.	7618.	14650.	2072.	9672.	18600.	1967.	11804.	22700.	ATLANTIC
LB16D	2128.	11180.	21500.	962.	3692.	7100.	1110.	3796.	7300.	ATLANTIC
LB17A	1263.	9382.	18043.	481.	6552.	12600.	740.	7384.	14200.	NORTH
LB17B	1926.	14307.	27514.	2146.	14196.	27300.	2479.	16536.	31800.	NORTH
LB17C	2847.	20956.	40300.	2146.	14196.	27300.	2479.	16536.	31800.	NORTH
LB18A	1684.	7332.	14100.	2294.	11388.	21900.	2405.	11648.	22400.	HERALD
LB19A	6028.	43680.	84000.	6845.	38584.	74200.	7289.	39884.	76700.	STORROW SB
LB19B	7913.	45719.	87922.	4773.	32448.	62400.	5143.	33852.	65100.	STORROW SB
LB19C	7913.	45719.	87922.	6623.	46020.	88500.	6967.	47996.	92300.	STORROW SB
LB19D	6995.	40415.	77722.	5624.	37128.	71400.	6031.	38792.	74600.	STORROW SB
LB19E	6143.	35493.	68256.	5624.	37128.	71400.	6031.	38792.	74600.	STORROW SB
LB19F	6143.	35493.	68256.	6697.	44928.	86400.	7067.	47164.	90700.	STORROW SB
LB19G	7207.	47554.	91450.	6697.	44928.	86400.	7067.	47164.	90700.	STORROW SB
LB19H	7207.	47554.	91450.	7141.	47528.	91400.	7363.	49660.	95500.	STORROW SB
LB19I	2621.	20202.	38850.	814.	10608.	20400.	851.	10712.	20600.	STORROW SB
LB19J	5770.	48932.	94100.	2072.	18200.	35000.	1887.	18252.	35100.	STORROW 2WAY
LB20H	2850.	23816.	45800.	1258.	7592.	14600.	1036.	7540.	14500.	STORROW NB
LB21A	2120.	15749.	30286.	1961.	6344.	12200.	2035.	6708.	12900.	ARTERY
LB21B	1101.	8179.	15729.	703.	3120.	6000.	777.	2964.	5700.	ARTERY

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - BOSTON LOCAL ROADS

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LB22A	405.	3009.	5786.	444.	2309.	4440.	481.	2501.	4810.	SOUTH
LB23A	826.	572.	1100.	1116.	5538.	10650.	1186.	5798.	11150.	W 4TH
LB24A	959.	5031.	9675.	2554.	10400.	20000.	2647.	10712.	20600.	ALBANY
LB24B	959.	5031.	9675.	1998.	7904.	15200.	2072.	7488.	14400.	ALBANY
LB24C	2141.	7696.	14800.	2109.	9880.	19000.	2294.	8736.	16800.	ALBANY
LB24D	1727.	12688.	24400.	3182.	7748.	14900.	3515.	7228.	13900.	ALBANY
LB25A	1742.	12941.	24886.	481.	312.	600.	518.	728.	1400.	PURCHASE
LB25B	1742.	12941.	24886.	1850.	9204.	17700.	1961.	7228.	13900.	PURCHASE
LB25C	2642.	19626.	37743.	925.	4680.	9000.	999.	5096.	9800.	PURCHASE
LB26A	950.	7383.	13571.	2412.	15722.	28900.	2405.	16211.	29800.	BLACKSTONE
LB26B	228.	1772.	3257.	1792.	10880.	20000.	1846.	11750.	21600.	BLACKSTONE
LB29A	2190.	14040.	27000.	3682.	12428.	23900.	3545.	13416.	25800.	RUTHERFORD W
LB29BB	2190.	14040.	27000.	3682.	12428.	23900.	3545.	13416.	25800.	RUTHERFORD
LB31A	2639.	22100.	42500.	1591.	13312.	25600.	1998.	15392.	29600.	SUMNER TUNNEL
LB31B	3375.	25071.	48214.	1517.	9464.	18200.	1636.	9776.	18800.	SUMNER TUNNEL
LB34	0.	0.	0.	333.	3484.	6700.	370.	3484.	6700.	PURCHASE EXTENDED
LB35	0.	0.	0.	666.	9932.	19100.	740.	10088.	19400.	PURCHASE EXTENDED
LB36	0.	0.	0.	1332.	17888.	34400.	1221.	18304.	35200.	PURCHASE EXTENDED
LB37	0.	0.	0.	821.	11024.	21200.	756.	11336.	21800.	SURFACE ART/CROSS
LB38	0.	0.	0.	0.	0.	0.	0.	0.	0.	SURF ART/CROSS ST

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS1A	1129.	6344.	12200.	944.	7189.	13825.	981.	7345.	14125.	SUMMER
LS1B	1721.	7722.	14850.	1592.	10556.	20300.	1629.	10712.	20600.	SUMMER
LS1C	1721.	11388.	21900.	2132.	18070.	34750.	2169.	18252.	35100.	SUMMER
LS1D	1690.	11804.	22700.	2288.	18070.	34750.	2327.	18252.	35100.	SUMMER
LS1E	1690.	11804.	22700.	2370.	17056.	32800.	2444.	18928.	36400.	SUMMER
LS1F	1915.	14222.	27350.	2756.	17056.	32800.	2831.	18928.	36400.	SUMMER
LS1G	1326.	10556.	20300.	2350.	17056.	32800.	3267.	18928.	36400.	SUMMER
LS2A	376.	2720.	5000.	259.	2475.	4550.	297.	2584.	4750.	E 1ST
LS2B	376.	2258.	4150.	500.	2747.	5050.	537.	2856.	5250.	W 1ST
LS3A	750.	5549.	10200.	778.	4597.	8450.	778.	4651.	8550.	E BROAD
LS3B	750.	5549.	10200.	1055.	7548.	13875.	1055.	7657.	14075.	W BROAD
LS3C	2624.	11206.	20600.	2241.	16293.	29950.	2242.	15477.	28450.	W BROAD
LS4A	1418.	10036.	19300.	1425.	10478.	20150.	1462.	10681.	20540.	COL/DAY
LS4B	1418.	10036.	19300.	1425.	10478.	20150.	1462.	10681.	20540.	COL/DAY
LS4C	1418.	10036.	19300.	1425.	10478.	20150.	1462.	10681.	20540.	COL/DAY
LS4D	322.	3042.	5850.	593.	10478.	20150.	532.	10681.	20540.	SOUTH
LS4E	423.	4264.	8200.	1331.	8866.	17050.	1369.	8996.	17300.	SOUTH
LS5A	1398.	7020.	13500.	1554.	11791.	22675.	1665.	12519.	24075.	COL/OLD COL
LS5B	1448.	11310.	21750.	1554.	11791.	22675.	1665.	12519.	24075.	OLD COL
LS5C	1902.	13052.	25100.	1943.	13104.	25200.	2054.	13832.	26600.	OLD COL
LS5D	1506.	10660.	20500.	1569.	13104.	25200.	1643.	13832.	26600.	OLD COL
LS6A	1490.	7176.	13800.	1832.	11726.	22550.	1869.	11882.	22850.	DAY
LS7A	844.	5954.	11450.	1481.	4160.	8000.	1525.	4290.	8250.	BOST/DORCH
LS7B	746.	5512.	10600.	907.	6344.	12200.	1040.	6640.	12770.	BOST/DORCH
LS7C	2124.	12194.	23450.	2183.	13026.	25050.	2261.	13754.	26450.	BOST/DORCH
LS7D	1570.	8450.	16250.	2183.	13026.	25050.	2261.	13754.	26450.	BOST/DORCH
LS7E	1382.	7176.	13800.	2183.	13026.	25050.	2261.	13754.	26450.	BOST/DORCH
LS7F	868.	2990.	5750.	2183.	13026.	25050.	2261.	13754.	26450.	BOST/DORCH
LS8A	268.	1924.	3700.	328.	4368.	8400.	328.	4680.	9000.	D ST
LS8B	608.	4290.	8250.	648.	4368.	8400.	685.	4680.	9000.	D ST
LS8C	587.	3796.	7300.	590.	3484.	6700.	685.	3796.	7300.	D ST
LS8D	659.	3380.	6500.	590.	3484.	6700.	833.	3796.	7300.	D ST
LS8E	612.	4546.	8743.	590.	3484.	6700.	833.	3796.	7300.	D ST
LS10A	573.	4576.	8800.	537.	2886.	5550.	592.	3302.	6350.	A ST

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - SOUTH BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LS10B	914.	6227.	11975.	759.	5044.	9700.	898.	5268.	10130.	A ST
LS10C	1160.	7501.	14425.	759.	5044.	9700.	898.	5268.	10130.	A ST
LS11A	764.	4732.	9100.	1018.	529.	1018.	1034.	538.	1034.	VIADUCT
LS12A	208.	1222.	2350.	270.	140.	270.	281.	146.	281.	B ST NE
LS14A	904.	5382.	10350.	921.	8060.	15500.	925.	8710.	16750.	NORTHERN
LS14B	1042.	6292.	12100.	1003.	8060.	15500.	1196.	8710.	16750.	NORTHERN
LS14C	1577.	9386.	18050.	2271.	14872.	28600.	2343.	15236.	29300.	NORTHERN
LS15A	231.	1764.	3500.	640.	8014.	15900.	744.	8266.	16400.	CONGRESS
LS15B	985.	4862.	9350.	2043.	8268.	15900.	2307.	8528.	16400.	CONGRESS
LS15C	839.	4862.	9350.	2043.	8268.	15900.	2082.	8528.	16400.	CONGRESS
LS17A	515.	3629.	7200.	867.	429.	851.	866.	413.	820.	METCHER
LS18A	144.	975.	1875.	352.	1885.	3625.	389.	1989.	3825.	W 2ND
LS18B	354.	1781.	3425.	588.	1885.	3625.	609.	1989.	3825.	W 2ND

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE2A	126.	858.	1650.	126.	858.	1650.	126.	858.	1650.	JEFFRIES
LE3A	306.	2184.	4200.	296.	2236.	4300.	296.	2340.	4500.	MAVERICK
LE3B	361.	2262.	4350.	391.	2236.	4300.	391.	2340.	4500.	MAVERICK
LE3C	374.	2574.	4950.	404.	2236.	4300.	404.	2340.	4500.	MAVERICK
LE3D	633.	4394.	8450.	633.	2236.	4300.	633.	2340.	4500.	MAVERICK
LE4A	234.	1248.	2400.	222.	1300.	2500.	222.	1404.	2700.	SUMNER
LE4B	475.	2600.	5000.	475.	1300.	2500.	475.	1404.	2700.	SUMNER
LE4C	436.	2600.	5000.	436.	1300.	2500.	436.	1404.	2700.	SUMNER
LE4D	387.	2782.	5350.	387.	1300.	2500.	387.	1404.	2700.	SUMNER
LE5A	78.	302.	600.	67.	302.	600.	67.	302.	600.	COTTAGE
LE5B	67.	252.	500.	67.	252.	500.	67.	252.	500.	COTTAGE
LE6A	171.	932.	1850.	171.	932.	1850.	171.	932.	1850.	ORLEANS
LE6B	132.	857.	1700.	114.	726.	1440.	114.	726.	1440.	ORLEANS
LE7A	122.	1040.	2000.	122.	1586.	3050.	122.	1586.	3050.	BREMEN
LE7B	454.	1586.	3050.	403.	1586.	3050.	415.	1586.	3050.	BREMEN
LE7C	449.	4420.	8500.	463.	6188.	11900.	444.	5200.	10000.	BREMEN
LE7D	395.	5954.	11450.	469.	6188.	11900.	426.	4940.	9500.	BREMEN
LE7E	189.	2145.	4125.	198.	1778.	3420.	217.	1846.	3550.	BREMEN
LE8A	333.	2938.	5650.	333.	2938.	5650.	333.	3099.	5960.	CHELSEA
LE8B	312.	1898.	3650.	352.	1898.	3650.	389.	2002.	3850.	CHELSEA
LE8C	663.	4550.	8750.	592.	5798.	11150.	592.	6318.	12150.	CHELSEA
LE8D	760.	8255.	15875.	600.	4888.	9400.	599.	4784.	9200.	CHELSEA
LE8E	1086.	8112.	15600.	653.	5356.	10300.	690.	5512.	10600.	CHELSEA
LE8F	744.	6890.	13250.	814.	4576.	8800.	851.	4940.	9500.	CHELSEA
LE9A	385.	2340.	4500.	385.	1508.	2900.	385.	1612.	3100.	MERIDIAN
LE9B	858.	8320.	16000.	737.	3432.	6600.	737.	3432.	6600.	MERIDIAN
LE9C	897.	7147.	13745.	969.	8060.	15500.	1014.	8320.	16000.	MERIDIAN
LE9D	815.	6404.	12315.	741.	5356.	10300.	796.	5356.	10300.	MERIDIAN
LE12A	547.	4368.	8400.	555.	426.	820.	555.	447.	860.	BENNINGTON
LE12B	836.	5876.	11300.	740.	5148.	9900.	740.	4992.	9600.	BENNINGTON
LE12C	1114.	9945.	19125.	1776.	13078.	25150.	1850.	13728.	26400.	BENNINGTON
LE13A	60.	806.	1600.	74.	806.	1600.	74.	806.	1600.	SARATOGA
LE13B	146.	1159.	2300.	148.	1159.	2300.	148.	1159.	2300.	SARATOGA
LE13C	503.	4876.	9675.	510.	4944.	9810.	510.	4944.	9810.	SARATOGA

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE13D	684.	6854.	13600.	693.	2772.	5500.	693.	2772.	5500.	SARATOGA
LE14B	175.	1159.	2300.	167.	454.	900.	167.	454.	900.	MARION
LE15A	419.	2270.	4365.	463.	2392.	4600.	481.	2392.	4600.	CONDOR
LE15B	419.	2270.	4365.	463.	2392.	4600.	481.	2392.	4600.	CONDOR
LE16A	569.	3458.	6650.	587.	2392.	4600.	606.	2392.	4600.	E EAGLE
LE17A	352.	2243.	4450.	398.	2535.	5030.	440.	2535.	5030.	HAVRE
LE17B	41.	295.	586.	46.	333.	660.	51.	333.	660.	HAVRE
LE18A	414.	3146.	6050.	259.	3016.	5800.	333.	3016.	5800.	PORTER SB
LE18B	422.	988.	1900.	490.	2704.	5200.	594.	3172.	6100.	PORTER SB
LE18C	732.	3497.	6725.	440.	2428.	4670.	754.	4004.	7700.	PORTER SB
LE18D	661.	3653.	7025.	446.	2463.	4730.	668.	3567.	6860.	PORTER NB
LE18E	658.	8177.	15725.	763.	4212.	8100.	928.	4888.	9400.	PORTER NB
LE18F	525.	3939.	7575.	609.	3276.	6300.	740.	4118.	7920.	PORTER NB
LE19A	1270.	10400.	20000.	1184.	9412.	18100.	1480.	9932.	19100.	ACCESS
LE19B	1863.	15314.	29450.	2748.	19552.	37600.	3362.	21632.	41600.	ACCESS
LE19C	2155.	16009.	30786.	2669.	14664.	28200.	4083.	16224.	31200.	ACCESS
LE19D	2070.	15377.	29571.	3467.	19968.	38400.	3943.	22984.	44200.	ACCESS
LE19E	2070.	15377.	29571.	3467.	19968.	38400.	3943.	22984.	44200.	ACCESS
LE19F	2070.	15377.	29571.	0.	0.	0.	0.	0.	0.	ACCESS
LE19G	1990.	14783.	28429.	0.	0.	0.	0.	0.	0.	ACCESS
LE19H	1823.	13520.	26000.	0.	0.	0.	0.	0.	0.	ACCESS
LE19I	916.	4368.	8400.	2072.	10140.	19500.	2730.	11752.	22600.	RAMP ON
LE19J	847.	8710.	16750.	1036.	8476.	16300.	1369.	8996.	17300.	RAMP ON
LE19K	533.	4472.	8600.	1332.	9464.	18200.	1650.	10712.	20600.	RAMP OFF
LE20A	477.	5408.	10400.	0.	0.	0.	0.	0.	0.	SERVICE RD
LE20B	1160.	8617.	16571.	0.	0.	0.	0.	0.	0.	SERVICE RD
LE20C	879.	4394.	8450.	0.	0.	0.	0.	0.	0.	SERVICE RD
LE20D	580.	4309.	8286.	0.	0.	0.	0.	0.	0.	SERVICE RD
LE20E	505.	2834.	5450.	0.	0.	0.	225.	0.	0.	SERVICE RD
LE20F	505.	2834.	5450.	375.	1950.	3750.	225.	1170.	2250.	SERVICE RD
LE20G	505.	2834.	5450.	375.	1950.	3750.	225.	1170.	2250.	SERVICE RD
LE20H	562.	3822.	7350.	375.	1950.	3750.	225.	1170.	2250.	SERVICE RD
LE20I	562.	4628.	8900.	375.	1950.	3750.	225.	1170.	2250.	SERVICE RD
LE20J	967.	6162.	11850.	375.	1950.	3750.	225.	1170.	2250.	SERVICE RD
LE21A	2847.	20956.	40300.	2035.	13676.	26300.	2944.	14196.	27300.	TUNNEL NB 1A

TABLE 2 (CONT'D)

TRAFFIC VOLUMES FOR THE PREFERRED ALTERNATIVE - EAST BOSTON

ROAD LINK ID	1982 ONE-HOUR	1982 EIGHT-HOUR	1982 24-HOUR	1990 ONE-HOUR	1990 EIGHT-HOUR	1990 24-HOUR	2010 ONE-HOUR	2010 EIGHT-HOUR	2010 24-HOUR	COMMENTS
LE21B	2847.	19344.	40300.	1740.	12624.	26300.	2514.	13104.	27300.	TUNNEL NB 1A
LE21C	2579.	17328.	36100.	2331.	12624.	26300.	2516.	13104.	27300.	TUNNEL NB 1A
LE21D	1309.	7728.	16100.	1036.	3936.	8200.	1036.	3936.	8200.	TUNNEL NB 1A
LE21E	1309.	7728.	16100.	1036.	3936.	8200.	1036.	3936.	8200.	TUNNEL NB 1A
LE21F	2225.	11760.	24500.	3105.	13296.	27700.	3766.	14784.	30800.	TUNNEL NB 1A
LE22A	2639.	22100.	42500.	1443.	15028.	28900.	1813.	15288.	29400.	TUNNEL NB 1A
LE22B	1902.	14424.	30050.	1406.	13872.	28900.	1739.	14112.	29400.	TUNNEL NB 1A
LE22C	1930.	14424.	30050.	1406.	11280.	23500.	1739.	12048.	25100.	TUNNEL NB 1A
LE22D	1930.	14424.	30050.	1406.	11280.	23500.	1739.	12048.	25100.	TUNNEL NB 1A
LE22E	1930.	14424.	30050.	988.	11280.	23500.	1739.	12048.	25100.	TUNNEL NB 1A
LE22F	1616.	10512.	21900.	2964.	3456.	7200.	370.	3744.	7800.	TUNNEL NB 1A
LE22G	1616.	10512.	21900.	2964.	3456.	7200.	2020.	3744.	7800.	TUNNEL NB 1A
LE23A	3841.	22272.	46400.	3774.	29712.	61900.	5386.	30240.	63000.	TUNNEL NB 1A
LE23AA	2255.	14796.	30825.	4329.	24624.	51300.	4699.	24480.	51000.	TUNNEL NB 1A

TRAFFIC INPUT DATA FOR THE INTERSECTION AT
LEVERETT CIRCLE
FOR THE 1 HOUR

	APPROACHES		
	CHARLES EB	CHARLES RIVER DAM	NASHUA WB
SIGNAL CYCLE LENGTH (SEC)	60	60	60
GREEN PHASE LENGTH (SEC)	24	27	22
NUMBER OF LANES	5	3	4
APPROACH CAPACITY (VPH)	3600	2430	2664
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	3551	1324	1471
1990 NO-BUILD	3441	814	3003
2-LANE CONCEPT	4044	762	1018
PREFERRED	3589	777	596
2010 NO-BUILD	4107	962	2183
2-LANE CONCEPT	4224	777	1204
PREFERRED	3737	777	659

TABLE 4

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
LEVERETT CIRCLE
FOR THE 8 HOUR

	APPROACHES		
	CHARLES EB	CHARLES RIVER DAM	NASHUA WB
SIGNAL CYCLE LENGTH (SEC)	60	60	60
GREEN PHASE LENGTH (SEC)	24	27	22
NUMBER OF LANES	5	3	4
APPROACH CAPACITY (VPH)	3600	2430	2664
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	2938	1398	832
1990 NO-BUILD	3478	1567	1300
2-LANE CONCEPT	3497	1606	1001
PREFERRED	3289	1560	1066
2010 NO-BUILD	3549	1014	1417
2-LANE CONCEPT	3517	1619	995
PREFERRED	3374	1632	1073

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
BELL CIRCLE
FOR THE 1 HOUR

APPROACHES

	ROUTE 1 SB	ROUTE 1 NB THRU	RTE.1 NB RT.TURN	R.B.PKWY SB	R.B.PKWY NB
SIGNAL CYCLE LENGTH (SEC)	143	143	143	143	143
GREEN PHASE LENGTH (SEC)	74	74	74	60	74
NUMBER OF LANES	3	2	1	2	2
APPROACH CAPACITY (VPH)	2808	1872	936	1512	1872
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	896	948	569	1022	777
1990 NO-BUILD	925	1029	617	1258	875
2-LANE CONCEPT	962	1064	638	1295	1110
PREFERRED	888	1064	638	1221	1110
2010 NO-BUILD	999	1087	652	1073	1295
2-LANE CONCEPT	1073	1110	666	1332	1147
PREFERRED	999	1110	666	1295	1147

TABLE 6

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
BELL CIRCLE
FOR THE 8 HOUR

APPROACHES

	ROUTE 1 SB	ROUTE 1 NB THRU	RTE.1 NB RT.TURN	R.B.PKWY SB	R.B.PKWY NB
SIGNAL CYCLE LENGTH (SEC)	143	143	143	143	143
GREEN PHASE LENGTH (SEC)	74	74	74	60	74
NUMBER OF LANES	3	2	1	2	2
APPROACH CAPACITY (VPH)	2808	1872	936	1512	1872
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	1812	762	457	962	657
1990 NO-BUILD	879	578	347	1035	464
2-LANE CONCEPT	928	608	364	1024	755
PREFERRED	930	626	375	1047	715
2010 NO-BUILD	950	595	357	963	518
2-LANE CONCEPT	1005	652	391	986	845
PREFERRED	1027	663	397	988	761

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST. AND X-WAY OFF RAMP
FOR THE 1 HOUR

	APPROACHES		
	KNEELAND EB	KNEELAND WB	X-WAY OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	33	31	59
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	1188	1116	3186
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	199	326	1330
1990 NO-BUILD	34	407	1221
2-LANE CONCEPT	37	296	851
PREFERRED	296	592	1036
2010 NO-BUILD	36	222	962
2-LANE CONCEPT	37	370	888
PREFERRED	296	481	1073

TABLE 8

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST. AND X-WAY OFF RAMP
FOR THE 8 HOUR

	APPROACHES		
	KNEELAND EB	KNEELAND WB	X-WAY OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	85	85	85
GREEN PHASE LENGTH (SEC)	24	21	49
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	1008	900	2088
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	345	458	943
1990 NO-BUILD	20	319	819
2-LANE CONCEPT	39	215	605
PREFERRED	319	299	865
2010 NO-BUILD	26	267	1710
2-LANE CONCEPT	72	253	663
PREFERRED	351	299	1001

TABLE 9

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST., SURFACE ARTERY, AND X-WAY ON RAMP
FOR THE 1 HOUR

	APPROACHES			
	KNEELAND SB	KNEELAND WB	SURFACE SB	KNEELAND EB - RT
SIGNAL CYCLE LENGTH (SEC)	100	100	100	100
GREEN PHASE LENGTH (SEC)	47	28	42	80
NUMBER OF LANES	2	3	4	1
APPROACH CAPACITY (VPH)	1692	1512	3024	1440
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	532	595	1725	387
1990 NO-BUILD	636	703	2026	645
2-LANE CONCEPT	471	814	1880	780
PREFERRED	355	98	1913	542
2010 NO-BUILD	682	877	1856	571
2-LANE CONCEPT	474	768	1777	850
PREFERRED	352	136	2128	643

TABLE 10

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
KNEELAND ST., SURFACE ARTERY, AND X-WAY ON RAMP
FOR THE 8 HOUR

	APPROACHES			
	KNEELAND SB	KNEELAND WB	SURFACE SB	KNEELAND EB - RT
SIGNAL CYCLE LENGTH (SEC)	86	86	86	86
GREEN PHASE LENGTH (SEC)	43	21	31	65
NUMBER OF LANES	2	3	4	1
APPROACH CAPACITY (VPH)	1800	1296	2592	1350
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	494	553	1603	359
1990 NO-BUILD	580	728	1203	421
2-LANE CONCEPT	332	540	975	552
PREFERRED	277	64	1040	424
2010 NO-BUILD	584	1034	1196	424
2-LANE CONCEPT	572	611	1066	626
PREFERRED	244	94	1267	447

TABLE 11

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & SUMMER STREET
FOR THE 1 HOUR

	APPROACHES				
	ATLANTIC NB	SUMMER WB THRU	SUMMER WB RT	SUMMER EB THRU	SUMMER EB LT
SIGNAL CYCLE LENGTH (SEC)	100	100	100	100	100
GREEN PHASE LENGTH (SEC)	25	35	15	52	28
NUMBER OF LANES	3	2	1	2	1
APPROACH CAPACITY (VPH)	1350	1260	270	1872	504
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	647	488	253	424	322
1990 NO-BUILD	896	632	499	1020	716
2-LANE CONCEPT	587	417	284	945	1048
PREFERRED	666	533	59	666	0
2010 NO-BUILD	1075	643	362	1131	1056
2-LANE CONCEPT	707	471	283	984	1023
PREFERRED	736	339	59	676	0

TABLE 12

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & SUMMER STREET
FOR THE 8 HOUR

	APPROACHES				
	ATLANTIC NB	SUMMER WB THRU	SUMMER WB RT	SUMMER EB THRU	SUMMER EB LT
SIGNAL CYCLE LENGTH (SEC)	86	86	86	86	86
GREEN PHASE LENGTH (SEC)	22	34	10	47	20
NUMBER OF LANES	3	2	1	2	1
APPROACH CAPACITY (VPH)	1404	1440	216	1980	414
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	601	453	235	340	299
1990 NO-BUILD	923	592	312	767	598
2-LANE CONCEPT	696	186	126	709	786
PREFERRED	757	267	25	595	0
2010 NO-BUILD	936	761	358	740	618
2-LANE CONCEPT	663	272	163	766	736
PREFERRED	708	250	26	604	0

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & CONGRESS STREET
FOR THE 1 HOUR

	APPROACHES			
	ATLANTIC NB	CONGRESS NWB	CONGRESS SEB THRU	CONGRESS SEB LT
SIGNAL CYCLE LENGTH (SEC)	90	90	90	90
GREEN PHASE LENGTH (SEC)	21	26	61	31
NUMBER OF LANES	2	2	2	1
APPROACH CAPACITY (VPH)	828	1004	2448	612
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	969	631	777	365
1990 NO-BUILD	1866	962	1066	261
2-LANE CONCEPT	1920	749	1189	130
PREFERRED	488	1133	305	120
2010 NO-BUILD	2247	1119	1121	248
2-LANE CONCEPT	1997	810	1300	123
PREFERRED	545	1147	404	80

TABLE 14

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE & CONGRESS STREET
FOR THE 8 HOUR

	APPROACHES			
	ATLANTIC NB	ATLANTIC NWB	CONGRESS SEB THRU	CONGRESS SEB LT
SIGNAL CYCLE LENGTH (SEC)	83	83	83	83
GREEN PHASE LENGTH (SEC)	20	24	37	28
NUMBER OF LANES	2	2	2	1
APPROACH CAPACITY (VPH)	864	1044	1620	612
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	689	553	1047	552
1990 NO-BUILD	1320	345	800	423
2-LANE CONCEPT	1294	33	1119	122
PREFERRED	321	61	303	167
2010 NO-BUILD	1346	494	873	462
2-LANE CONCEPT	1281	72	1182	112
PREFERRED	359	61	388	100

TABLE 15

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE/NORTHERN AVENUE/OLIVER STREET
FOR THE 1 HOUR

	APPROACHES		
	ATLANTIC AVENUE	NORTHERN AVENUE	OLIVER STREET
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	51	41	41
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	2754	1476	1476
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	1769	1304	0
1990 NO-BUILD	1724	1825	0
2-LANE CONCEPT	0	0	0
PREFERRED	2348	1563	37
2010 NO-BUILD	2306	1850	0
2-LANE CONCEPT	0	0	0
PREFERRED	2355	1603	37

TABLE 16

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE|NORTHERN AVENUE/OLIVER STREET
FOR THE 8 HOUR

	APPROACHES		
	ATLANTIC AVENUE	NORTHERN AVENUE	OLIVER STREET
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	60	32	32
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	3240	1152	1152
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	953	637	0
1990 NO-BUILD	1040	1612	0
2-LANE CONCEPT	0	0	0
PREFERRED	1677	897	26
2010 NO-BUILD	1203	1710	0
2-LANE CONCEPT	0	0	0
PREFERRED	1735	875	26

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
N. WASHINGTON STREET & COMMERCIAL STREET
FOR THE 1 HOUR

	APPROACHES			
	CAUSEWAY EB	COMMERC'L WB	N.WASH.ST NB	N.WASH.ST SB
SIGNAL CYCLE LENGTH (SEC)	127	127	127	127
GREEN PHASE LENGTH (SEC)	47	18	60	60
NUMBER OF LANES	2	3	2	3
APPROACH CAPACITY (VPH)	1332	756	1692	2538
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	1148	1062	1238	1161
1990 NO-BUILD	2317	1020	740	2331
2-LANE CONCEPT	917	891	1341	1831
PREFERRED	922	888	1584	2072
2010 NO-BUILD	1776	864	777	2701
2-LANE CONCEPT	1379	1093	1175	2066
PREFERRED	962	1036	1628	2220

TABLE 18

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
N. WASHINGTON STREET & COMMERCIAL STREET
FOR THE 8 HOUR

APPROACHES

	CAUSEWAY EB	COMMERC'L WB	N.WASH.ST NB	N.WASH.ST SB
SIGNAL CYCLE LENGTH (SEC)	127	127	127	127
GREEN PHASE LENGTH (SEC)	47	18	60	60
NUMBER OF LANES	2	3	2	3
APPROACH CAPACITY (VPH)	1332	756	1692	2538
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	725	582	588	1222
1990 NO-BUILD	1463	559	774	1372
2-LANE CONCEPT	709	506	761	683
PREFERRED	559	475	813	624
2010 NO-BUILD	1034	473	813	1482
2-LANE CONCEPT	696	527	852	780
PREFERRED	650	481	865	787

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQUARE (CHARLESTOWN)
FOR THE 1 HOUR

	APPROACHES	
	N.WASH.ST NB	CHELSEA WB
SIGNAL CYCLE LENGTH (SEC)	110	110
GREEN PHASE LENGTH (SEC)	76	34
NUMBER OF LANES	3	1
APPROACH CAPACITY (VPH)	2850	433
DEMAND VOLUMES (VPH) by Alternative:		
1982 EXISTING	2754	410
1990 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0
2010 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0

TABLE 20

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQUARE (CHARLESTOWN)
FOR THE 8 HOUR

	APPROACHES	
	N.WASH.ST NB	CHELSEA WB
SIGNAL CYCLE LENGTH (SEC)	80	80
GREEN PHASE LENGTH (SEC)	35	45
NUMBER OF LANES	3	1
APPROACH CAPACITY (VPH)	1805	788
DEMAND VOLUMES (VPH) by Alternative:		
1982 EXISTING	1008	429
1990 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0
2010 NO-BUILD	0	0
2-LANE CONCEPT	0	0
PREFERRED	0	0

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQ/N.WASH/RUTHERFURD/CHELSEA/XWAY OFF RAMP
FOR THE 1 HOUR

	APPROACHES			
	N.WASH.ST NB	RUTHR'FD SB	CHELSEA WB	X-WAY OFF RAMP EB
SIGNAL CYCLE LENGTH (SEC)	120	120	120	120
GREEN PHASE LENGTH (SEC)	34	33	32	26
NUMBER OF LANES	6	5	3	3
APPROACH CAPACITY (VPH)	2338	1891	1100	894
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	0	0	0	0
1990 NO-BUILD	2886	1924	1443	1147
2-LANE CONCEPT	2382	1548	1398	1059
PREFERRED	2553	1663	1470	1036
2010 NO-BUILD	3219	2146	1480	1221
2-LANE CONCEPT	2875	1649	1384	1169
PREFERRED	2767	1793	1480	1258

TABLE 22

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CITY SQ/N.WASH/RUTHERFORD/CHELSEA/XWAY OFF RAMP
FOR THE 8 HOUR

APPROACHES

	N.WASH.ST NB	RUTHR'FD SB	CHELSEA WB	X-WAY OFF RAMP EB
SIGNAL CYCLE LENGTH (SEC)	120	120	120	120
GREEN PHASE LENGTH (SEC)	32	22	28	48
NUMBER OF LANES	6	5	3	3
APPROACH CAPACITY (VPH)	2200	1260	963	1650

DEMAND VOLUMES (VPH) by Alternative:	0	0	0	0
1982 EXISTING	1593	793	793	1086
	1294	813	884	1203
1990 NO-BUILD	1177	767	826	1164
2-LANE CONCEPT				
PREFERRED	1846	813	800	1218
	1378	748	995	1287
2010 NO-BUILD	1313	780	923	1320
2-LANE CONCEPT				
PREFERRED				

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST.,NEW ARTERY SB OFF RAMP/SB CONNECTOR
FOR THE 1 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	X-WAY OFF RAMP SB
SIGNAL CYCLE LENGTH (SEC)	80	80	80
GREEN PHASE LENGTH (SEC)	25	25	55
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	1219	1219	997
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	517	1365	760
PREFERRED	522	1378	888
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	571	1387	743
PREFERRED	555	1434	939

TABLE 24

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST./NEW ARTERY SB OFF RAMP/SB CONNECTOR
FOR THE 8 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	X-WAY OFF RAMP SB
SIGNAL CYCLE LENGTH (SEC)	70	70	70
GREEN PHASE LENGTH (SEC)	25	25	45
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	1393	1393	932
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	481	1112	910
PREFERRED	436	930	839
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	494	1131	930
PREFERRED	475	956	806

TABLE 25

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST./NEW ARTERY NB ON RAMP/NB CONNECTOR
FOR THE 1 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	NB CONNECTOR
SIGNAL CYCLE LENGTH (SEC)	80	80	80
GREEN PHASE LENGTH (SEC)	31	31	49
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	1511	1511	1776
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	439	1130	961
PREFERRED	372	1110	1064
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	485	1141	1340
PREFERRED	444	1295	1149

TABLE 26

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CAUSEWAY ST./NEW ARTERY NB ON RAMP/NB CONNECTOR
FOR THE 8 HOUR

	APPROACHES		
	CAUSEWAY WB	CAUSEWAY EB	NB CONNECTOR
SIGNAL CYCLE LENGTH (SEC)	70	70	70
GREEN PHASE LENGTH (SEC)	30	30	40
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	1671	1671	1657
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	176	988	787
PREFERRED	156	852	618
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	176	982	813
PREFERRED	156	917	644

TABLE 27

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVE/SURFACE ARTERY/STATE STREET
FOR THE 1 HOUR

	APPROACHES				
	ATLANTIC NB	ATLANTIC SB	SURFACE SB	SURFACE NB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	100	100	100	100	100
GREEN PHASE LENGTH (SEC)	50	50	45	45	55
NUMBER OF LANES	3	3	3	3	2
APPROACH CAPACITY (VPH)	1950	1950	1755	1755	1320
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	1214	576	1210	1400	515
1990 NO-BUILD	1702	1073	1110	1480	703
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0
2010 NO-BUILD	1591	1110	1332	1591	725
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0

TABLE 28

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVE./SURFACE ARTERY/STATE STREET
FOR THE 8 HOUR

	APPROACHES				
	ATLANTIC NB	ATLANTIC SB	SURFACE SB	SURFACE NB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	70	70	70	70	70
GREEN PHASE LENGTH (SEC)	34	34	29	29	41
NUMBER OF LANES	3	3	3	3	2
APPROACH CAPACITY (VPH)	1894	1894	1616	1616	1406
DEMAND VOLUMES (VPH) by Alternative:					
1982 EXISTING	520	662	1024	946	346
1990 NO-BUILD	572	728	995	878	364
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0
2010 NO-BUILD	696	904	910	884	450
2-LANE CONCEPT	0	0	0	0	0
PREFERRED	0	0	0	0	0

TABLE 29

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE/SURFACE ARTERY/STATE STREET
FOR THE 1 HOUR

	APPROACHES		
	ATLANTIC NB	SURFACE SB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	45	45	45
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	2063	2063	1200
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	1797	1319	555
PREFERRED	1245	1142	185
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	2038	1545	592
PREFERRED	1345	1238	196

TABLE 30

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
ATLANTIC AVENUE/SURFACE ARTERY/STATE STREET
FOR THE 8 HOUR

	APPROACHES		
	ATLANTIC NB	SURFACE SB	STATE WB
SIGNAL CYCLE LENGTH (SEC)	80	80	80
GREEN PHASE LENGTH (SEC)	41	41	39
NUMBER OF LANES	3	3	2
APPROACH CAPACITY (VPH)	2114	2114	1170
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	1229	1066	709
PREFERRED	650	1248	260
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	1300	1151	715
PREFERRED	663	1261	267

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & WEST TUNNEL RAMPS
FOR THE 1 HOUR

	APPROACHES		
	CONGRESS STREET	TUNNEL CONNECTOR	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	30	60	60
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	1800	2400	2400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	496	505	395
PREFERRED	467	829	541
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	555	528	507
PREFERRED	475	841	691

TABLE 32

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & WEST TUNNEL RAMPS
FOR THE 8 HOUR

	APPROACHES		
	CONGRESS STREET	TUNNEL CONNECTOR	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	30	60	60
NUMBER OF LANES	3	2	2
APPROACH CAPACITY (VPH)	1800	2400	2400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	719	235	1111
PREFERRED	530	172	858
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	806	260	1286
PREFERRED	586	190	949

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
SUMMER ST. & TUNNEL RAMPS
FOR THE 1 HOUR

	APPROACHES		
	SUMMER WB	SUMMER EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	70	70	20
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	4200	4200	400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	902	1163	89
PREFERRED	1001	1170	284
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	914	1201	113
PREFERRED	1002	1210	210

TABLE 34

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
SUMMER ST. & TUNNEL RAMPS
FOR THE 8 HOUR

	APPROACHES		
	SUMMER WB	SUMMER EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	70	70	20
NUMBER OF LANES	3	3	1
APPROACH CAPACITY (VPH)	4200	4200	400
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	449	429	105
PREFERRED	1674	1601	364
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	508	486	119
PREFERRED	1680	1638	364

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NORTHERN AVE & EAST TUNNEL RAMPS
FOR THE 1 HOUR

	APPROACHES		
	NORTHERN WB	NORTHERN EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	60	60	30
NUMBER OF LANES	2	2	2
APPROACH CAPACITY (VPH)	2400	2400	1200
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	555	581	163
PREFERRED	626	437	114
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	639	677	184
PREFERRED	673	434	84

TABLE 36

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NORTHERN AVE & EAST TUNNEL RAMPS
FOR THE 8 HOUR

	APPROACHES		
	NORTHERN WB	NORTHERN EB	TUNNEL OFF RAMP
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	60	60	30
NUMBER OF LANES	2	2	2
APPROACH CAPACITY (VPH)	2400	2400	1200
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	254	293	165
PREFERRED	191	223	117
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	322	371	196
PREFERRED	191	223	117

TABLE 37

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & SEAPORT ACCESS ROAD
FOR THE 1 HOUR

	APPROACHES			
	CONGRESS SB	CONGRESS NB	SEAPORT EB	SEAPORT EB
SIGNAL CYCLE LENGTH (SEC)	80	80	80	80
GREEN PHASE LENGTH (SEC)	34	34	46	46
NUMBER OF LANES	2	2	2	2
APPROACH CAPACITY (VPH)	1530	1530	2070	2070
DEMAND VOLUMES (VPH) by Alternative:				
1982 EXISTING	0	0	0	0
1990 NO-BUILD	349	407	370	851
2-LANE CONCEPT	0	0	0	0
PREFERRED	0	0	0	0
2010 NO-BUILD	375	629	407	851
2-LANE CONCEPT	0	0	0	0
PREFERRED	0	0	0	0

TABLE 38

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
CONGRESS STREET & SEAPORT ACCESS ROAD
FOR THE 8 HOUR

APPROACHES

	CONGRESS SB	CONGRESS NB	SEAPORT EB	SEAPORT WB
SIGNAL CYCLE LENGTH (SEC)	80	80	80	80
GREEN PHASE LENGTH (SEC)	34	34	46	46
NUMBER OF LANES	2	2	2	2
APPROACH CAPACITY (VPH)	1530	1530	2070	2070
DEMAND VOLUMES (VPH) by Alternative:	0	0	0	0
1982 EXISTING	689	254	247	702
	0	0	0	0
1990 NO-BUILD	0	0	0	0
2-LANE CONCEPT PREFERRED	650	267	302	728
	0	0	0	0
2010 NO-BUILD	0	0	0	0
2-LANE CONCEPT PREFERRED				

TABLE 39

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON ST./NEW CHARDON/CROSS ST.
FOR THE 1 HOUR

	APPROACHES		
	N.WASH.ST SB	N.WASH.ST NB	CROSS STREET
SIGNAL CYCLE LENGTH (SEC)	100	100	100
GREEN PHASE LENGTH (SEC)	67	67	33
NUMBER OF LANES	3	2	1
APPROACH CAPACITY (VPH)	2764	1843	454
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	1161	621	279
1990 NO-BUILD	1147	703	629
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0
2010 NO-BUILD	1221	777	666
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0

TABLE 40

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON ST./NEW CHARDON/CROSS ST.
FOR THE 8 HOUR

APPROACHES

	N.WASH.ST SB	N.WASH.ST NB	CROSS WB
SIGNAL CYCLE LENGTH (SEC)	90	90	90
GREEN PHASE LENGTH (SEC)	59	59	31
NUMBER OF LANES	3	2	1
APPROACH CAPACITY (VPH)	2704	1803	474
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	813	195	309
1990 NO-BUILD	845	735	540
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0
2010 NO-BUILD	761	767	748
2-LANE CONCEPT	0	0	0
PREFERRED	0	0	0

TABLE 41

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON/SB CONNECTOR/CROSS/NEW CHARDON
FOR THE 1 HOUR

APPROACHES

	N.WASH.ST NB	SB CONNECTOR	SUM OFF R &CROSS WB
SIGNAL CYCLE LENGTH (SEC)	130	130	130
GREEN PHASE LENGTH (SEC)	43	53	44
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	910	1682	1396
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	1221	2049	1659
PREFERRED	1110	1815	851
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	1184	1965	1903
PREFERRED	1147	1146	1149

TABLE 42

TRAFFIC INPUT DATA FOR THE INTERSECTION AT:
NO. WASHINGTON/SB CONNECTOR/CROSS/NEW CHARDON
FOR THE 8 HOUR

	APPROACHES		
	N.WASH.ST NB	SB CONNECTOR	SUM OFF R &CROSS WB
SIGNAL CYCLE LENGTH (SEC)	120	120	120
GREEN PHASE LENGTH (SEC)	33	54	43
NUMBER OF LANES	2	2	3
APPROACH CAPACITY (VPH)	756	1238	1478
DEMAND VOLUMES (VPH) by Alternative:			
1982 EXISTING	0	0	0
1990 NO-BUILD	0	0	0
2-LANE CONCEPT	787	1151	1503
PREFERRED	715	1046	774
2010 NO-BUILD	0	0	0
2-LANE CONCEPT	845	1281	1684
PREFERRED	814	747	1017

TABLE 43

TRAFFIC INPUT DATA FOR SUMNER TUNNEL TOLL BOOTHS

Alternative	Peak Hour Demand Volume*	Peak Hour Queue Length*	Peak Hour Average Delay*	Eight Hour Demand Volume	Eight Hour Queue Length	Eight Hour Average Delay
1982 Existing	2850	75	5.75	2420	28	2.16
1990 No-Build	2812	195	10.75	2587	73	4.00
2 Lane Concept	2146	1	0.28	2282	0.375	0.105
Preferred	1591	1	0.26	1664	0.375	0.0975
2010 No-Build	3258	225	12.50	2899	84	4.75
2 Lane Concept	2479	180	9.48	2477	67.5	3.555
Preferred	1998	1	0.27	1924	0.375	0.1013

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane (3 lanes total), and average delay is in minutes per vehicle.

TABLE 44

TRAFFIC INPUT DATA FOR CALLAHAN TUNNEL ENTRANCE

Alternative	Peak Hour Demand Volume*	Peak Hour Queue Length*	Peak Hour Average Delay*	Eight Hour Demand Volume	Eight Hour Queue Length	Eight Hour Average Delay
1982 Existing	2850	19	2.68	2420	7	1.01
1990 No-Build	3737	132	4.85	2847	50	1.80
2 Lane Concept	2886	0	0	2347	0	0
Preferred	2146	0	0	1775	0	0
2010 No-Build	4070	171	6.30	3068	64	2.40
2 Lane Concept	3071	48	0.85	2548	18	.3188
Preferred	2479	0	0	2067	0	0

*Demand volumes are in vehicles per hour, queue length is in vehicles per approach lane (3 lanes total), delay is in minutes per vehicle.

TABLE 45

TRAFFIC INPUT DATA FOR CALLAHAN TUNNEL TOLL BOOTHS

Alternative	Peak Hour Demand Volume*	Peak Hour Queue Length*	Peak Hour Average Delay*	Eight Hour Demand Volume	Eight Hour Queue Length	Eight Hour Average Delay
1982 Existing	2850	4	0.57	2420	4	0.61
1990 No-Build	3737	235	8.65	2847	88	3.25
[1]2 Lane Concept	2886	20	0.79	2347	7.5	0.2963
[2]Preferred	2146	0	0	1775	0	0
2010 No-Build	4070	392	14.50	3068	147	5.50
[1]2 Lane Concept	3071	56	1.49	2548	21	0.559
[2]Preferred	2479	0	0	2067	0	0

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane (7 lanes total, 6 for 8-hr), and average delay is in minutes per vehicle.

[1]Two-way toll.

[2]One-way toll at Sumner Tunnel - no toll at Callahan.

TABLE 46

TRAFFIC INPUT DATA FOR PROPOSED TUNNEL TOLL BOOTHS - NORTHBOUND

Alternative	Peak Hour Demand Volume*	Peak Hour Queue Length*	Peak Hour Average Delay*	Eight Hour Demand Volume	Eight Hour Queue Length	Eight Hour Average Delay
1982 Existing	NA**	NA	NA	NA	NA	NA
1990 No-Build	NA	NA	NA	NA	NA	NA
[1] 2 Lane Concept	1258	3	0.52	966	1.125	0.195
[2] Preferred	2150	0	0	1752	0	0
2010 No-Build	NA	NA	NA	NA	NA	NA
[1] 2 Lane Concept	1702	28	1.37	1272	10.5	0.5138
[2] Preferred	2520	0	0	2064	0	0

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane, and average delay is in minutes per vehicle.

**NA means not applicable.

[1] Number of approach lanes for the 2 Lane Concept is 1. Toll is two way.

[2] Number of approach lanes for the Preferred Alternative is 2. Toll is one way (southbound only).

TABLE 47

TRAFFIC INPUT DATA FOR PROPOSED TUNNEL TOLL BOOTHS - SOUTHBOUND

Alternative	Peak Hour Demand Volume*	Peak Hour Queue Length*	Peak Hour Average Delay*	Eight Hour Demand Volume	Eight Hour Queue Length	Eight Hour Average Delay
1982 Existing	NA	NA	NA	NA	NA	NA
1990 No-Build	NA	NA	NA	NA	NA	NA
[1]2 Lane Concept	1036	1	0.44	942	0.375	0.165
[2]Preferred	1702	1	0.35	1740	0.375	0.1313
2010 No-Build	NA	NA	NA	NA	NA	NA
[1]2 Lane Concept	1443	7	0.66	1254	2.625	0.2475
[2]Preferred	2146	4	0.42	1998	1.5	0.1575

*Demand volumes are in vehicles per hour, queue length is the average number of vehicles per lane (2 lanes total), and average delay is in minutes per vehicle.

**NA means not applicable.

[1]Number of approach lanes for the 2 Lane Concept is 1.

[2]Number of approach lanes for the Preferred Alternative is 2.

TABLE 48

AVERAGE ROUTE SPEED BY FACILITY TYPE AND GEOGRAPHIC AREA FOR PEAK HOUR

		Average Speed by Alternative and Year in Miles Per Hour					
		1990			2010		
Location	Facility Type	1	5A.2[1]	5A.7[2]	1	5A.2[1]	5A.7[2]
Boston	Expressway	26	30	38	24	38	38
	Arterial	24	22	24	22	24	24
	Collector	20	20	20	19	20	20
	Local	16	20	20	15	20	20
South Boston	Expressway	34	35	35	32	33	33
	Arterial	25	26	26	23	26	26
	Collector	22	22	22	21	22	22
	Local	21	21	21	21	21	20
	Proposed Tunnel	NA*	35	40	NA	32	37
East Boston	Route 1A	32	35	35	31	34	34
	All Tunnels	21	35	35	16	34	34
	Arterial	22	23	23	21	22	22
	Collector	21	21	21	20	21	21
	Local	21	21	21	20	21	21

*NA means not applicable.
1 Refers to the 2 Lane Tunnel Concept
2 Refers to the Preferred Alternative

TABLE 49

AVERAGE ROUTE SPEED BY FACILITY TYPE AND GEOGRAPHIC AREA FOR 8- AND 24-HOUR

		Average Speed by Alternative and Year in Miles Per Hour					
		1990			2010		
Location	Facility Type	1	5A.2 [1]	5A.7 [2]	1	5A.2 [1]	5A.7 [2]
Boston	Expressway	39	48	48	36	48	48
	Arterial	29	29	29	28	29	29
	Collector	25	25	25	24	25	25
	Local	23	24	24	22	24	24
South Boston	Expressway	47	48	48	45	47	46
	Arterial	31	31	31	30	31	31
	Collector	27	27	27	26	26	26
	Local	25	25	25	24	24	24
	Proposed Tunnel	NA*	39	44	NA	37	42
East Boston	Route 1A	36	39	39	35	35	39
	All Tunnels	26	38	38	24	38	38
	Arterial	27	27	27	25	26	26
	Collector	24	24	24	24	24	24
	Local	24	24	24	24	24	24

*NA means not applicable.

1 Refers to 2 Lane Tunnel Concept

2 Refers to Preferred Alternative

TABLE 50

EXISTING TUNNELS - INPUT PARAMETERS

		Sumner	Callahan	Dewey Square Southbound	Dewey Square Northbound*
No. of Lanes		2	2	3	3
Distance (Ft)		5680	5200	2360	2360
No-Build Alternative					
1982	1-hr Volume	2639	2847	4498	4196
	Speed	25	25	30	30
1990	1-hr Volume	2812	3737	6549	5624
	Speed	21	21	26	26
2010	1-hr Volume	3258	4070	6882	5550
	Speed	16	16	24	24
2 Lane Tunnel Concept					
1990	1-hr Volume	2146	2886	2960	3700
	Speed	35	35	38	38
2010	1-hr Volume	2479	3071	2812	4292
	Speed	34	34	38	38
Preferred Alternative					
1990	1-hr Volume	1591	2146	3256	3367
	Speed	35	35	38	38
	1-hr Volume	1998	2479	3404	3404
	Speed	34	34	38	38

*For the Preferred Alternative and the 2 Lane Tunnel Concept, the Fort Point Channel Split Alignment, both of the Dewey Square Tunnels will be used for southbound traffic.

TABLE 51

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	1-Hr Volumes 2010
Tunnel Segments Served by VO at South Bay				
2-Lane Tunnel Concept				
A-0	1	300	925	962
A-0	1	300	296	370
A-0	1	700	1258	1295
A-0	1	400	652	963
A-0-SBD	2	300	1910	2258
A-0-NBD	1	700	592	740
A-0	1	500	222	222
A-0	1	300	777	925
A-0	1	200	1036	1147
A-0-NBD	5	700	4889	5291
A-0	1	500	510	600
J-0	5	1575	4921	5143
J-0-NBD	3	300	3885	3996
J-0	1	500	1036	1147
B-0-SBD	2	300	1910	2258
B-0	1	100	592	740
B-0-NBD	2	400	999	1295
B-0	5	300	4884	5291
B-0	1	400	510	600
Preferred Alternative				
A-0-NB	4	300	3441	3737
B-0	2	1000	1480	1739
A-0	1	600	370	296
B-0	2	400	1110	1443
B-0-NB	3	900	2331	2331
A-0	1	400	1554	1628
A-0	1	200	296	333
A-0	1	200	666	814
B-0	1	1200	666	814
B-0-NB	3	300	2146	2553

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by V0 at South Bay				
Preferred Alternative (Cont'd.)				
J-0-SB	2	1000	2331	2775
J-0	1	400	740	888
J-0	2	400	1591	1887
A-0	1	300	740	888
A-0	1	400	1258	1406
A-0	1	400	333	481
J-0-SB	4	1575	4144	4292
J-0-SB	1	800	1850	1961
Tunnel Segments Served by Vent V1 at Northern Ave				
2 Lane Tunnel Concept				
J-1-NBD	5	1575	4921	5143
E-1-NBD	5	540	4921	5143
E-1-SBD	5	500	5994	6179
Preferred Alternative				
J-1-NB	4	1575	4144	4292
J-1	1	1400	703	629
J-1-SB	4	200	5057	5069
E-1-SB	4	350	5057	5069
E-1	1	200	703	629
E-1-NB	4	400	4144	4292
Tunnel Segments Served by Vent V3 at Harbor Towers				
2 Lane Tunnel Concept				
E-3	1	400	2183	1961
E-3-NBD	5	360	4921	5143
E-3-NBD	5	100	7104	7104
E-3-NBD	5	500	5994	6179
F-3-NBD	5	850	7104	7104
F-3-SBD	5	850	5994	6179

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by Vent V3 at Harbor Towers (Cont'd.)				
Preferred Alternative				
E-3-NB	4	400	4144	4292
E-3	2	300	2442	2109
E-3-SB	4	350	5057	5069
E-3	1	900	900	962
F-3-NB	6	1200	6623	6475
F-3-SB	5	1800	5957	6031
Tunnel Segments Served by Vent V4 at Callahan Tunnel				
2 Lane Tunnel Concept				
F-4-NBD	5	850	4477	4218
F-4	1	900	2405	2442
F-4-SBD	5	600	3589	3700
G-4-NBD	5	1500	4477	4218
G-4-SBD	5	1600	3589	3700
Preferred Alternative				
F-4-NB	4	1000	4773	4699
F-4	1	700	1813	1887
F-4-SB	4	300	4144	4255
G-4-NB	5	900	4773	4699
G-4	1	1200	1036	1258
G-4-SB	4	900	4144	4225
Tunnel Segments Served by Vent V5 at Causeway Street				
2 Lane Tunnel Concept				
G-5	1	200	555	629
G-5	2	250	2146	2479
G-5	1	800	814	962
G-5-NBD	5	700	5254	5180
G-5	1	200	1332	1369

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by Vent V5 at Causeway Street (Cont'd.)				
2 Lane Tunnel Concept				
G-5	2	400	2886	3071
G-5	1	1500	1554	1702
G-5-SBD	5	800	4477	4699
H-5-SBD	2	1000	4477	4699
H-5-NBD	2	2800	5254	5180
Preferred Alternative				
G-5	1	800	1036	1258
G-5-NB	5	1100	5709	5957
G-5-SB	5	1100	5180	5515
H-5	1	1000	1702	1998
H-5	2	1000	2109	2257
H-5	2	1800	2109	2257
Tunnel Segments Served by Vent V7 at A and Summer Streets				
2 Lane Tunnel Concept				
B-7-NBD	2	1320	1591	2035
B-7	1	700	407	700
B-7-SBD	2	1320	1910	1320
B-7	1	500	1041	500
Preferred Alternative				
B-7-NB	3	500	2146	2553
B-7-NBD	2	500	1702	2092
B-7	1	500	143	185
B-7	1	900	296	259
B-7	1	600	444	444
B-7-SB	2	600	1850	2333
B-7-SB	3	500	2331	2775

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by V8 at Viaduct and Summer Streets				
2 Lane Tunnel Concept				
B-8-NBD	2	1400	1258	1739
B-8	1	550	74	148
B-8-SBD	2	1400	1054	1443
B-8	1	700	185	298
Preferred Alternative				
B-8-NB	2	700	1702	2092
B-8-NB	2	700	2146	2516
B-8	1	550	444	444
B-8-SB	2	800	1850	2333
B-8-SB	2	600	1409	1776
B-8	1	800	441	557
B-8	1	1300	339	370
Tunnel Segments Served by V9 at Naval Base				
2 Lane Tunnel Concept				
B-9-NBD	1	750	1258	1739
B-9-SBD	1	750	1054	1443
C-9-NBD	1	1900	1258	1739
C-9-SBD	1	1900	1054	1443
Preferred Alternative				
B-9-SBD	2	750	1702	2146
B-9-NBD	2	750	2146	2516
C-9-SBD	2	1900	1702	1702
C-9-NB	2	1900	2146	2546
Tunnel Segments Served by V10 at Bird Island Flats				
2 Lane Tunnel Concept				
C-10-NBD	1	1900	1258	1739
C-10-SBD	1	1900	1054	1443
C-10-NBD	1	3000	1258	1739
D-10-SBD	1	3000	1054	1443

TABLE 51 (CONT'D.)

TUNNEL SEGMENT INPUT PARAMETERS FOR PROPOSED TUNNEL

Segment ID	No. of Lanes	Length (Ft)	1-Hr Volumes 1990	2010
Tunnel Segments Served by V10 at Bird Island Flats (Cont'd.)				
Preferred Alternative				
C-10-NB	2	1900	2146	2516
C-10-SB	2	1900	1702	2146
D-10	1	1500	322	414
D-10	1	500	714	918
D-10	1	1000	1036	1332
D-10-NB	2	2400	1026	1184
D-10-NB	2	3200	2146	2516
D-10	1	1600	999	1157
D-10-SB	2	400	551	814
D-10-SB	2	900	1550	1971
D-10	1	700	152	172
D-10-SB	2	3200	1702	2146

TABLE 52

EXHAUST VENTS EMISSION CHARACTERISTICS

	Volumetric Rate (x 10^3 m^3/sec)	Exhaust Area (m^2)	Exhaust Velocity (m/sec)	1990 q_{CO} (g/sec)	1990 q_{NOX} (g/sec)	2010 q_{CO} (g/sec)	2010 q_{NOX} (g/sec)
2 Lane Tunnel Concept							
V0	0.98	96.2	10.2	30.41	2.60	27.63	2.33
V1	0.62	185.0	7.3	21.62	1.85	18.85	1.59
V3	0.65	62.0	10.4	25.99	2.47	19.83	2.12
V4	1.12	101.7	11.0	30.59	2.90	22.65	2.42
V5	0.90	88.7	10.2	46.81	4.44	35.97	3.84
V7	0.31	62.2	4.9	8.75	0.75	8.82	0.74
V8	0.32	44.6	7.3	5.49	0.47	6.40	0.54
V9	0.25	53.9	4.6	9.88	0.84	11.38	0.96
V10	0.46	138.0	4.7	18.27	1.56	19.57	1.80
S1	0.77	97.6	4.0	11.97	1.02	10.76	0.99
S2	0.77	97.6	4.0	7.69	0.66	6.91	0.64
C1	0.86	97.6	4.4	11.23	0.96	9.30	0.86
C2	0.86	97.6	4.4	12.97	1.11	10.74	0.99
DSSB1	0.56	58.0	4.8	5.69	0.54	4.07	0.43
DSSB2	0.56	58.0	4.8	4.69	0.45	3.36	0.36
DSNB1	0.71	58.0	6.1	5.94	0.56	5.19	0.55
DSNB2	0.71	58.0	6.1	7.03	0.67	6.14	0.66
Preferred Alternative							
V0	1.02	96.2	10.2	28.13	2.80	24.70	2.55
V1	0.55	185.0	10.2	17.30	1.72	14.06	1.45
V3	0.98	62.2	10.2	35.14	3.33	26.41	2.82
V4	0.72	101.7	10.2	24.60	2.33	18.83	2.01
V5	0.87	88.7	10.2	30.34	2.88	24.54	2.62
V7	0.34	62.2	10.2	6.87	0.69	6.53	0.68
V8	0.39	44.6	6.8	8.66	0.86	8.40	0.87
V9	0.50	53.9	10.2	14.59	1.45	13.26	1.37
V10	1.56	138.0	10.2	43.99	3.76	41.55	3.83
S1	0.77	97.6	4.0	14.57	1.25	14.25	1.31
S2	0.77	97.6	4.0	14.57	1.25	14.25	1.31
C1	0.86	97.6	4.4	17.99	1.54	16.18	1.49
C2	0.86	97.6	4.4	17.99	1.54	16.18	1.49
DSSB1	0.56	58.0	4.8	11.42	1.08	8.99	0.96
DSSB2	0.56	58.0	4.8	11.42	1.08	8.99	0.96
DSNB1	0.71	58.0	6.1	11.81	1.12	8.99	0.96
DSNB2	0.71	58.0	6.1	11.81	1.12	8.99	0.96

TABLE 53

VENTILATION REQUIREMENTS AND ESTIMATED 1-HR NITROGEN DIOXIDE AND CARBON MONOXIDE CONCENTRATIONS* IN TUNNEL SEGMENTS UNDER
THE PREFERRED ALTERNATIVE IN 1990

Tunnel or Vent ID	Tunnel Segment ID	Ventilation Requirements (m^3/sec)	NO_2 (mg/m^3)	CO (mg/m^3)
Vent V0	A-0-NBD	57	2.60	26.1
	B-0	94	2.23	22.4
	A-0	28	1.17	11.2
	B-0	38	1.67	16.8
	B-0-NBD	128	2.35	23.5
	A-0	19	4.69	47.05
	A-0	9	0.89	8.96
	A-0	9	2.01	20.17
	B-0	57	2.01	20.17
	B-0-NB	43	2.16	21.66
	J-0-SBD	94	3.52	35.29
	J-0	19	2.23	22.41
	J-0	38	2.40	24.09
	A-0	14	2.23	22.41
	A-0	19	3.80	38.09
	A-0	19	1.01	10.08
	J-0-SB	298	3.13	31.37
	J-0-SB	38	5.58	56.01
Total for Vent V0		1021		
Average for Vent V0			2.54	25.43
Vent V1	J-1-NBD	298	3.13	31.37
	J-1	66	2.12	21.29
	J-1-SBD	38	3.82	38.28
	F-1-SB	66	3.82	38.28
	E-1	9	2.12	21.29
	E-1-NB	76	3.13	31.37
Total for Vent 1		553		
Average for Vent V1			3.02	30.31
Vent 3	E-3-N	76	3.09	32.59
	E-3	284	3.64	38.41
	E-3-SB	66	3.77	39.77
	E-3	43	2.69	28.31
	F-3-NB	340	3.29	34.72
	F-3-SB	425	3.56	37.48
Total for Vent V3		1234		
Average for Vent V3			3.34	35.21

*Entries do not include background levels.

TABLE 53 (CONT'D.)

VENTILATION REQUIREMENTS AND ESTIMATED 1-HR NITROGEN DIOXIDE AND CARBON MONOXIDE CONCENTRATIONS* IN TUNNEL SEGMENTS UNDER THE PREFERRED ALTERNATIVE IN 1990

Tunnel or Vent ID	Tunnel Segment ID	Ventilation Requirements (m3/sec)	NO_2 (mg/m3)	CO (mg/m3)
Vent V4	F-4-N	189	3.56	37.54
	F-4	33	5.41	57.03
	F-4-S	57	3.09	32.59
	G-4-N	213	2.85	30.03
	G-4	57	3.09	32.59
	G-4-S	170	3.09	32.59
Total for Vent V4		719		
Average for Vent V4			3.52	37.06
Vent V5	G-5	38	3.09	32.59
	G-5-N	260	3.41	35.92
	G-5-S	260	3.09	32.59
	H-5	47	5.08	53.54
	H-5	95	3.15	33.17
	H-5	170	3.15	33.17
Total for Vent V5		870		
Average for Vent V5			3.50	36.83
Vent V7	B-7-N	71	2.16	21.66
	B-7-N	47	2.57	25.77
	B-7	24	4.32	43.30
	B-7	43	0.89	8.96
	B-7	28	1.34	13.44
	B-7-S	57	2.79	28.01
	B-7-S	71	2.35	23.53
Total for Vent V7		341		
Average for Vent V7			2.74	27.45
Vent V8	B-8-N	66	2.57	25.77
	B-8-N	66	3.23	32.49
	B-8	26	1.34	13.44
	B-8-S	76	2.79	28.01
	B-8-S	57	2.13	21.33
	B-8	38	1.33	13.35
	B-8	61	1.02	10.26
Total for Vent V8		390		
Average for Vent V8			2.40	24.11

TABLE 53 (CONT'D.)

VENTILATION REQUIREMENTS AND ESTIMATED 1-HR NITROGEN DIXOIDE AND CARBON MONOXIDE CONCENTRATIONS* IN TUNNEL SEGMENTS UNDER
THE PREFERRED ALTERNATIVE IN 1990

Tunnel or Vent ID	Tunnel Segment ID	Ventilation Requirements (m^3/sec)	NO_2 (mg/m^3)	(mg/m^3)
Vent V9	B-9-S	71	2.57	25.77
	B-9-N	71	3.23	32.49
	C-9-S	180	2.57	25.77
	C-9-N	180	3.23	32.49
Total for Vent V9		502		
Average for Vent V9			2.90	29.13
Vent V10	C-10	180	3.13	36.62
	C-10	180	2.48	29.05
	D-10	71	0.94	10.99
	D-10	24	2.08	24.37
	D-10	47	3.02	35.36
	D-10	227	1.50	17.51
	D-10	302	3.13	36.62
	D-10	76	2.92	34.10
	D-10	38	0.80	9.40
	D-1	85	2.26	26.45
	D-1	33	0.44	5.19
	D-1	302	2.48	29.05
Total for Vent V10		1565		
Average for Vent V10			2.10	24.56

TABLE 54

SOURCE INPUT DATA FOR ISC MODEL FOR THE PREFERRED ALTERNATIVE IN 1990

Vent ID	NO_x Emission Rate (g/sec)	Stack Height (m)	Source Temperature (°K)	Exit Velocity (m/sec)	Diameter (m)
V0	2.80	30.5	299	10.2	11.1
V1	1.72	30.5	299	10.2	10.4
V3	3.33	30.5	299	10.2	8.9
V4	2.33	30.5	299	10.2	11.4
V5	2.88	30.5	299	10.2	10.6
V7	0.69	30.5	299	10.2	8.9
V8	0.86	15.2	299	6.8	7.5
V9	1.45	22.9	299	10.2	8.3
V10	3.76	30.5	299	10.2	11.2
S1	1.25	35.1	299	4.0	11.2
S2	1.25	35.1	299	4.0	11.2
C1	1.54	35.1	299	4.4	11.2
C2	1.54	35.1	299	4.4	11.2
DSSB1	1.08	30.5	299	4.8	8.6
DSSB2	1.08	30.5	299	4.8	8.6
DSNB1	1.12	30.5	299	6.1	8.6
DSNB2	1.12	30.5	299	6.1	8.6

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NOISE AND VIBRATION

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PART 1 NOISE ANALYSIS

1.0 INTRODUCTION

Part I of this technical appendix provides background information on the noise analysis for the Preferred Alternative of the Central Artery/Third Harbor Tunnel Project. Details relating to the No-Build Alternative and Alternatives 3, 3A, 5, 5A, and 6 are contained in Appendix 6 of the DEIS/DEIR and the SDEIS/SDEIR. The reader is referred to these documents for background information on noise fundamentals, descriptors, measurements, prediction methods, and criteria.

1.1 ESTIMATION OF PROJECT NOISE LEVELS

1.1.1 Construction Noise

Prototype noise levels have been computed for anticipated project construction activities for the No-Build and Preferred Alternatives. The method used to perform these calculations is documented in Section I.4.1 of DEIS/DEIR Appendix 6 (pages 13-21).

A range of 88-93 dBA L_{eq} at 50 feet, based on a prototypical scenario, was used along with point source distance adjustments to compute noise levels at typical nearby sensitive receptors. Table 1 contains the results of these calculations compared with existing noise levels.

The noise increases listed in Table 1 can be converted to subjective terms using the Project Criteria for Increase in Noise Level:

0-5 dB increase:	No impact
5-10 dB increase:	Minor impact
10-15 dB increase:	Moderate impact
Greater than 15dB increase:	Substantial impact

Comparative results for the No-Build and Preferred Alternatives appear in Table 2. In terms of construction noise impact, both of these alternatives will have "substantial" impact on the Stillman Place residences in the North End, and, in addition, the Preferred Alternative will have "substantial" impact on the Spaulding Rehabilitation Hospital and the East Boston Recreation Area.

The prototype computations upon which this impact analysis is based hinge upon nationwide average construction scenarios. The actual construction noise will depend strongly upon equipment types, usage factors, equipment placement, operating conditions, and construction schedules for this very complex project. Once this information is developed further, during detailed design, noise computations can be made project-specific. Only then can detailed noise mitigation be assessed and incorporated.

Mitigation measures that can often reduce noise impact from construction operations include:

- Limiting noisy construction activities to daytime hours near residential areas.

- Ensuring that all diesel-powered equipment at the construction site has effective mufflers. Frequently, faulty or ineffective mufflers are a major source of construction noise. The prototype calculations assume that all equipment is properly muffled.

- Erecting temporary noise barriers between sensitive receptors and particularly noisy or close construction operations.

For impact pile driving, a major source of noise for the Preferred Alternative, potential noise control options include the use of shrouds and exhaust mufflers, or use of

TABLE 1

PROTOTYPE CONSTRUCTION NOISE ESTIMATES AT NEARBY SENSITIVE RECEPTORS

Receptor	Measurement Site No.	Project Alternatives	Distance to Nearest Construction (Ft)	Construction Noise (dBA L_{eq})	Existing Noise (dBA L_{eq})	Noise Increase (dBA)
Edward Everett House	17	Preferred	275	73-78	69	4-9
Charles River Dam Park	18	No-Build and Preferred	250	74-79	69	5-10
Mass. Rehab. Hospital	None	Preferred	50	88-93	71*	17-22
Casa Maria Housing	20	No-Build and Preferred	175	77-82	71	6-11
Stillman Place Residence	19	No-Build and Preferred	50	88-93	72	16-21
Quincy Market	21	No-Build and Preferred	100	82-87	71	11-16
Waterfront Park	16	No-Build	225	75-80	69	6-11
		Preferred	125	80-85	69	11-16
Harbor Tower Condominiums	(22A)	No-Build	250	74-79	69*	5-10
		Preferred	150	78-83	69*	9-14
Proposed Arts Bldg. (259 A St. in South Boston)	None	Preferred	50	88-93	70*	18-23
Boston Tea Party Museum	4	Preferred	200	76-81	65	11-16
Dockside Condominiums	3	Preferred	800	64-69	73	0
St. Peter and Paul Church	2	Preferred	500	68-73	63	5-10
Rotch Playground	1	Preferred	150	78-83	69	9-14
Albany Street Apartments	None	Preferred	400	70-75	66*	4-9
Maverick Street Residences (Jeffries Point)	12	Preferred	600	66-71	64	2-7
East Boston Recreation Area	10,11	Preferred	125	80-85	66	14-19
Porzio Park	13	Preferred	800	64-69	69	0
Bremen Street Residences (North of Porter Street)	8,9	Preferred	500	68-73	68-69	0-5

*Estimated from nearby and/or similar situation measurements.

TABLE 2

SUMMARY OF CONSTRUCTION NOISE IMPACT, RELATIVE TO EXISTING NOISE LEVELS

Receptor	Measurement Site No.	Impact by Alternative: No-Build Alternative	Impact by Alternative: Preferred Alternative
Edward Everett House	17	None	Minor
Charles River Dam Park	18	Minor	Minor
Mass. Rehab. Hospital	None	None	Substantial
Casa Maria Housing	20	Minor	Minor
Stillman Place Residence	19	Substantial	Substantial
Quincy Market	21	Moderate	Moderate
Waterfront Park	16	Minor	Moderate
Harbor Tower Condominiums	(22A)	Minor	Moderate
Proposed Arts Bldg. (259 A (Street in South Boston)	None	None	Substantial
Boston Tea Party Museum	4	None	Moderate
Dockside Condominums	3	None	None
St. Peter and Paul Church	2	None	Minor
Rotch Playground	1	None	Moderate
Albany Street Apartments	None	None	Minor
Maverick Street Residences (Jeffries Point)	12	None	None
East Boston Recreation Area	10,11	None	Substantial
Porzio Park	13	None	None
Bremen Street Residences (North of Porter Street)	8,9	None	None

alternative methods (e.g., caisson drilling, vibratory pile driving, or slurry wall construction).

1.1.2 Traffic Noise

Traffic noise from the Third Harbor Tunnel and its associated roadways was calculated in accordance with current FHWA procedures. Section I.4.2 of Appendix 6 of the DEIS/DEIR describes these procedures and all modifications to them used for this project.

Table 3 lists all of the traffic data used for calculation of noise for the Preferred Alternative at each site in the study area. For the vast majority of links, the design-year AM Peak traffic hour was found to be louder than the design-year PM Peak traffic hour. Therefore, for the Preferred Alternative, only the AM Peak traffic noise condition was evaluated. The Level-of-Service C automobile noise was evaluated and included as described in Appendix 6 of the DEIS/DEIR.

Calculation of indoor traffic noise levels was accomplished, where required, by reducing the predicted exterior noise levels by the expected outdoor-to-indoor noise reduction. For site 2 (closed windows), this noise reduction was taken to be 25 decibels. For sites 8, 9, 12, 19, 20, and 22A (open windows), this noise reduction was taken to be 10 decibels.

1.1.3 Ventilation Building Noise

Noise from the proposed tunnel ventilation buildings would result primarily from operation of the fans used for tunnel air supply and exhaust. The amount of noise generated by such fans would depend on the number of fans, the fan types, sizes, and air volume flow rates, the pressure drops across the fans, and the operating efficiencies of the fans. The resulting level of fan noise at any given noise-sensitive receptor in the community would further depend on the specific design configuration of the ventilation building duct system and on the distance and orientation of the vent building air intake and exhaust openings relative to the given receptor position.

As indicated by the above discussion, noise from the proposed ventilation buildings would depend strongly on design details, many of which have not yet been determined. Therefore, accurate estimates of ventilation building noise cannot be made at this time. However, during project design, a detailed acoustical analysis will be performed in order to estimate ventilation building noise at sensitive community locations. If such estimates exceed the applicable state and city guidelines or regulations, noise control treatments (e.g., special fan designs, lined ducts, mufflers, etc.) will be incorporated into the design in order to achieve acceptable noise levels. Thus, by using proper noise control design practice, it is anticipated that noise impact due to the proposed tunnel ventilation buildings will be avoided.

1.2 TRAFFIC NOISE LEVELS: ASSESSMENT AND POSSIBLE NOISE ABATEMENT

Noise levels were calculated at the 18 noise-sensitive receptor sites discussed in the FEIS/FEIR. Table 4 lists these sites and further generalizes them to include all (1) existing activities, (2) developed lands, and (3) undeveloped lands for which development is planned, designed, and programmed -- where such activities and lands are noise-sensitive and where they may be affected by noise from project roadways. The basis for these generalizations is that the selected analysis sites represent geometrical relationships to project roads that are similar to those for all noise-sensitive receptors that may be significantly affected by noise from these roads. Table 4 also indicates the approximate number of residents represented by the receptor sites.

TRAFFIC DATA USED FOR NOISE CALCULATIONS: PREFERRED ALTERNATIVE.

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
1	Albany St.	1,900	5.0	3.7		18
	Central Artery SB on-ramp from Albany St.	2,011	5.0	3.6	576	30/45
	Central Artery SB	4,180	4.9	3.4		40
	Central Artery NB	10,079	4.9	3.4	7200	18/50
	Central Artery NB off-ramp to W. Fourth St.					
	South of Underpass	2,309	5.0	3.7		30
	North of Underpass	3,221	5.0	3.7		20
	Randolph Rd. underpass	912	5.0	3.7		15
	West Fourth St. from Dorchester Ave. to Albany	393 (EB) 521 (WB)	1.0 2.8	2.5 0.4		30 30
2	Broadway Bridge EB	1,265	6.2	3.0		18
	Broadway Bridge WB	1,337	6.5	3.7	720	31/30
	West Fourth St. from Dorchester Ave. to Albany	393 (EB) 521 (WB)	1.0 2.8	2.5 0.4	280	30 24/25
	Central Artery NB off-ramp to Mass Pike WB	2,842	4.9	3.4		20
	Central Artery NB off-ramp to proposed tunnel	7,025	4.9	3.4	4320	36/50
	Service Road from West Fourth St. to Broadway Bridge	950	5.0	3.7		32
	Central Artery SB	4,180	4.9	3.4		13
	Albany St.	1,900	5.0	3.7		18

TABLE 3 (CONT'D.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
3,4	Dorchester Ave. NB South of Congress St.	1,551	5.0	3.7		23
	Dorchester Ave. SB South of Congress St.	810	5.0	3.7		30
	Congress St.	620 (EB) 325 (WB)	3.1 8.3	6.6 5.3		25 25
	Atlantic Ave.	2,090	5.0	3.7		18
	Central Artery SB	2,432	4.9	3.4		42
	Central Artery SB with exit ramp	2,470	4.9	3.4		40
8,9	Rt. 1A SB (Marion-Putnam)	988	2.2	0.9		40
	Rt. 1A NB	1,634	2.0	1.7		39
	Connector from merge of Airport Egress Rd and proposed tunnel off-ramp to Rt. 1A NB	1,026	2.1	0.5		25
	Airport Service Rd.	479	3.8	3.1		25
	Airport Egress Rd. Connector to Rt. 1A SB	1,454	0.6	0.3		25
	Bremen St. NB	152	6.9	2.9		25
	Bremen St. SB	380	3.0	1.2		25
10	Rt. 1A SB (Marion-Putnam)	988	2.2	0.9		40
	Rt. 1A NB	1,634	2.0	1.7		39
	Connector from merge of Airport Egress Rd. and proposed tunnel off-ramp to Rt. 1A NB	1,026	2.1	0.5		25

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
	Airport Service Rd.	479	3.8	3.1		25
	Airport Egress Rd. Connector to Rt. 1A SB	1,454	0.6	0.3		25
	Airport Egress Rd to Rt. 1A NB Connector	418	2.1	0.5		25
	Proposed tunnel off-ramp to Rt. 1A NB Connector	608	2.1	0.5		25
	Airport Egress Rd. (west of Airport Cross Rd.)	1,872	2.1	0.5		33
	Airport Access Rd. (west of Airport Cross Rd.)	4,152	2.5	1.3		29
11	Airport Egress Rd. Connector to Rt. 1A SB	1,454	0.6	0.3		25
	Airport Egress Rd to Rt. 1A NB Connector	418	2.1	0.5		25
	Proposed tunnel off-ramp to Rt. 1A NB Connector	608	2.1	0.5		25
	Airport Egress Rd. (west of Airport Cross Rd.)	1,872	2.1	0.5		33
	Airport Service Rd.	479	3.8	3.1		25
	Airport Access Rd. (west of Airport Cross Rd.)	4,152	2.5	1.3		29
	Airport Cross Rd. NB (Airport Egress Rd. - BIF Access Loop Rd.)	221	3.5	3.0		20
	Airport Cross Rd. SB (Airport Egress Rd. - BIF Access Loop Rd.)	576	3.5	3.0		20

TABLE 3 (CONT'D.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
	Airport Cross Rd. NB (BIF Access Loop Rd. - Airport Access Rd. on-ramp)	338	3.5	3.0		24
	Airport Cross Rd. SB (BIF Access Loop Rd. - Airport Access Rd. on-ramp)	2,156	3.5	3.0	1440	20/25
	Airport Cross Rd. NB (Airport Access Rd. on-ramp - proposed tunnel on-ramp)	796	3.5	3.0		24
	Airport Cross Rd. SB (Airport Acess Rd. on-ramp - proposed tunnel on-ramp)	1,692	3.5	3.0	1440	25/25
	Airport Access Rd. (east of Airport Cross Rd.)	1,175	2.0	1.0		32
	Airport Access Rd. (east of proposed tunnel off-ramps)	2,250	2.0	1.0		20
	Airport Central Parking Access Rd.	2,585	2.6	2.4		20
	BIF Access Loop Rd.	2,387	0.4	0.3		25
	Airport Egress Rd. (east of Airport Cross Rd.)	2,876	0.2	0.1		25
12,13	Proposed tunnel on-ramp from Airport Cross Rd.	60	0.1	0		16
	BIF Access Rd.	847	3.5	3.0		15
	Airport Cross Rd. NB (proposed tunnel on-ramp - BIF Access Rd.)	200	3.5	3.0		15
	Airport Cross Rd. SB (proposed tunnel on-ramp - BIF Access Rd.)	647	3.5	3.0		15

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
	Airport Cross Rd. NB (Airport Access Rd. on-ramp - proposed tunnel on-ramp)	796	3.5	3.0		24
	Airport Cross Rd SB (Airport Access Rd. on-ramp - proposed tunnel on-ramp)	1,692	3.5	3.0	1440	25/25
	Airport Access Rd. (west of Airport Cross Rd.)	4,152	2.5	1.3		29
	Airport Access Rd. (east of Airport Cross Rd.)	1,175	2.0	1.0		32
	Airport Access Rd. (east of proposed tunnel off-ramps)	2,550	2.0	1.0		20
	Airport Central Parking Access Rd.)	2,585	2.6	2.4		20
	Airport Cross Rd. NB (BIF Access Loop Rd. - Airport Access Rd. on-ramp)	338	3.5	3.0		25
	Airport Cross Rd. SB (BIF Access Loop Rd. - Airport Access Rd. on-ramp)	2,156	3.5	3.0	1440	20/25
	Airport Cross Rd. NB (Airport Egress Rd. - BIF Access Loop Rd.)	221	3.5	3.0		20
	Airport Cross Rd. SB (Airport Egress Rd. - BIF Access Loop Rd.)	576	3.5	3.0		20
	BIF Access Loop Rd.	2,387	0.4	0.3		25
	Airport Egress Rd. (east of Airport Cross Rd.)	2,876	0.2	0.1		25

TABLE 3 (CONT'D.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
	Airport Egress Rd. (west of Airport Cross Rd.)	1,872	2.1	0.5		33
	Airport Service Rd.	479	3.8	3.1		25
	Airport Egress Rd. Connector to Rt. 1A SB	1,454	0.6	0.3		25
	Airport Egress Rd. to Rt. 1A NB Connector	418	2.1	0.5		25
	Proposed tunnel off-ramp to Rt. 1A NB Connector	608	2.1	0.5		25
	Connector from merge of Airport Egress Rd. and proposed tunnel off-ramp to Rt. 1A NB	1,026	2.1	0.5		25
	Rt. 1A SB (Marion-Putnam)	988	2.2	0.9		40
	Rt. 1A NB	1,634	2.0	1.7		39
15,16	Surface Artery NB (East India Row-Waterfront Park)	418	5.0	3.7		31
	Surface Artery NB (Waterfront Park-Fulton St.)	418	5.0	3.7		24
	Surface Artery SB (Callahan Tunnel-Broad St.)	1,609	5.0	3.7		18
	Central Artery NB (Surface Artery off-ramp)	646	5.0	3.7		25
	Clinton St. (Commercial St. - Surface Artery NB)	76	5.0	3.7		25
	Atlantic Ave.	304	5.0	3.7		32
17,18	Charlestown Bridge NB	494	5.0	3.7		15
	Charlestown Bridge SB	2,128	5.0	3.7		29
	New Rutherford Ave. NB	2,432	5.0	3.7		30

TABLE 3 (CONT'D.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
	New Rutherford Ave. SB	1,026	5.0	3.7		31
	On-ramp Rt. 1 NB	1,710	5.0	3.6	778	18/45
	Rt. I-93 NB off-ramp	1,976	5.0	3.6		50
	Rt. I-93 NB on-ramp	760	5.0	3.6		27
	Rt. 1 SB off-ramp	988	4.9	3.4		27
	Rt. I-93 NB	5,016	4.9	3.4	4320	46/50
	Rt. I-93 NB Connector from Leverett Circle	950	5.0	3.6		28
	Rt. I-93 NB	5,928	4.9	3.4		37
	Rt. I-93 SB	7,942	4.9	3.4	5760	21/50
	Rt. I-93 SB	4,370	4.9	3.4		47
	Rt. I-93 SB off-ramp	3,572	5.0	3.6	2880	21/50
	Main St. (Charlestown)	152	5.0	3.7		25
	Harvard St. (Charlestown)	152	5.0	3.7		25
19,20	Surface Artery NB (Salem St.-N. Washington St.)	1,508	5.0	3.7	1440	25/25
	N. Washington St. EB	1,508	5.0	3.7	1440	25/25
	Surface Artery SB (Causeway St.-North St.)	2,877	5.0	3.7	2016	27/30
	Stillman St.	76	2.0	0		20
	Ramp from Sumner Tunnel to New Chardon St.	912	5.0	3.7		20
	Surface Artery NB (North Washington St.-Causeway St.) (Site 19 only)	1,889	5.0	3.7		30
	North Washington St. WB (Site 19 only)	1,482	5.0	3.7		25

TABLE 3 (CONT'D.)

Measurement Site	Roadway Link	Total Vehicle Volume (AM Pk.Hr.)	Medium Truck Percentage	Heavy Truck Percentage	Los 'C' Auto Volume	Speed/ 'C' Speed
21	Surface Artery NB (East India Row-Waterfront Park)	418	5.0	3.7		31
	Surface Artery NB (Waterfront Park-Fulton St.)	418	5.0	3.7		24
	Surface Artery SB (Callahan Tunnel-Broad St.)	1,609	5.0	3.7		18
	Commercial St. (Clinton St.-Surface Artery SB)	76	5.0	3.7		25
	Clinton St. (Commercial St. - Surface Artery NB)	76	5.0	3.7		25
	Central Artery NB (Surface Artery off-ramp)	646	5.0	3.7		25
22	Atlantic Ave. (Northern Ave.-East India Row)	532	5.0	3.7		31
	Surface Artery NB	418	5.0	3.7		31
	Surface Artery SB (State St.-Oliver St.)	228	5.0	3.7		24
	Central Artery SB	2,432	4.9	3.4		42
	Central Artery SB on-ramp	2,470	4.9	3.4		40

TABLE 4

IDENTIFICATION OF EXISTING ACTIVITIES, DEVELOPED LANDS, AND UNDEVELOPED LANDS FOR WHICH DEVELOPMENT IS PLANNED, DESIGNED, AND PROGRAMMED, WHICH MAY BE AFFECTED BY NOISE FROM THE HIGHWAY

	Site	Activity or Land Use Represented	Approximate No. of People Represented
1.	Rotch Playground	Rotch Playground, near half	-
2.	St. Peter and Paul Church	St. Peter and Paul Church	-
3.	Dockside Condominiums	Dockside Condominiums, Children's Museum and associated open space	80
4.	Boston Tea Party Museum	Boston Tea Party Museum	
8.	Bremen Street residence, 1-1/2 blocks northeast of Porter St.	All Bremen Street residences directly opposite the Airport Access Road	200
9.	Bremen Street residence, 2-1/2 blocks northeast of Porter St.	All Bremen Street residences out of direct line with the Airport Access Road	140
10.	East Boston Recreation Area, northwest baseball backstop	Northwest portions of the East Boston Recreation Area	-
11.	East Boston Recreation Area, southeast baseball backstop	Southeast portions of the East Boston Recreation Area	-
12.	Maverick Street residence	All Maverick Street residences between Jeffries and Lamson Sts.	120
13.	Porzio Park	Porzio Park	-
15.	Waterfront Park, Boston	Waterfront Park, near Atlantic Ave.	-
16.	Waterfront Park, Boston	Major portion of Waterfront Park	-
17.	Edward Everett House, City Square, Charlestown	Residences near City Square with a direct view of project roads	200
18.	Charles River Dam Park	Charles River Dam Park	-

TABLE 4 (CONT'D.)

Site	Activity or Land Use Represented	Approximate No. of People Represented
19. Stillman Place Residence, North End	Lower floors of residences along Stillman Place, Cooper Street, and Washington Street south of Thatcher Street, with facades toward the Central Artery	480
20. Casa Maria Housing, North End	Upper floors of nearby multi-story dwellings within 1 block of and with facades toward the Central Artery but with some shielding by other nearby buildings	340
21. Quincy Market Mall, Commercial Street at North Market Street	East end of Quincy Market Mall	-
22A. Harbor Tower Condominiums, Boston	Harbor Tower closest to the Central Artery; condominums with a view of the Central Artery	310

Table 5 is a noise summary for the No-Build and Preferred Alternatives. It combines the calculated noise from project roadways (these include both limited-access roadways and local streets -- but only those involved in project construction, either newly constructed or widened) with estimated noise from other sources into the total noise level at each receiver. This total noise level allows meaningful intercomparison among alternatives. Note that the No-Build Alternative contains no project roadways, and therefore project noise for this case does not appear in the table.

The FHWA requires that the total roadway noise be compared to their Noise Abatement Criteria (NAC) and to existing noise levels, to assess project noise impact. If feasible and reasonable, noise abatement is required where this total noise exceeds either of these two criteria.

Table 5 lists the applicable FHWA Noise Abatement Criteria. The criterion for sites 2, 8, 9, 12, 19, 20, and 22A is the indoor criterion of the FHWA. These Category-E sites have no exterior land use exposed to the project. The criterion for all other sites is the FHWA outdoor criterion (Category B).

Table 6 follows directly from these tabulated noise levels and criteria. It lists where "severe" noise impacts occur -- for which sites, under which alternatives, and whether the impact is due to excess over the Noise Abatement Criterion or due to a significant (15-decibel) increase over existing noise. The word "severe" follows usage recommended by the FHWA. The FHWA states that when the Noise Abatement Criteria are exceeded, the noise level is so bad that substantial mitigation must be provided, when it is reasonable and feasible to do so.

Where impact occurs in Table 6, noise barriers have been examined and evaluated, using FHWA-approved barrier calculation procedures. Such noise barriers, which block the line-of-sight between receivers and traffic, and thereby reduce the traffic noise, are discussed in detail in the FEIS/FEIR. In summary, noise barriers are likely to be built to provide noise abatement at sites 1, 11, and 19.

PART 2: VIBRATION ANALYSIS

2.0 INTRODUCTION

Part 2 of this technical appendix provides background information related to the vibration analysis for the Preferred Alternative. Details relating to the No-Build Alternative and Alternatives 3, 3A, 5, 5A, and 6 are contained in Appendix 6 of the DEIS/DEIR and its Supplement. The reader is referred to these documents for background information on vibration fundamentals, descriptors, measurements, prediction methods, and criteria. For convenience, a summary of the project vibration criteria is provided in Table 7.

2.1 VIBRATION ASSESSMENT AND MITIGATION

Assessment of potential vibration effects from construction and operation of the Preferred Alternative is accomplished by comparing predicted project vibrations with the project vibration criteria (see Table 7) and with measured existing vibrations (where appropriate). The methodology for vibration predictions is described in Sec. II. 4 of DEIS/DEIR Appendix 6 (pages 97-109).

The comparison of predicted vibrations with the criteria results in a set of distances from project vibration sources within which different types of vibration effects would be expected to occur for various types of buildings or structures. The estimated vibration "impact distances" thereby determined for general use in this assessment are summarized in

TABLE 5

TRAFFIC NOISE SUMMARY COMPARISON OF ALTERNATIVES, WITHOUT NOISE BARRIERS, YEAR 2010

		Daytime Hourly L_{eq} (dBA)**								
			No-Build Alternative			Preferred Alternative			FHWA FHWA	FHWA Noise Abatement
Site No.*	Description	Existing	P	N	TOT	P	N	TOT	Activity Category	Criterion (dBA L_{eq})
1	Rotch Playground	69	-	80	80	81	<65	81	B†	67
2	St. Peter and Paul Church***	38	-	47	47	45	38	46	E††	52
3	Dockside Condominiums	73	-	71	71	65	66	69	B	67
4	Boston Tea Party Museum	65	-	75	75	69	74	75	B	67
8	Bremen St. Residence**	59	-	65	65	51	62	62	E	52
9	Bremen St. Residence**	58	-	65	65	52	61	62	E	52
10	East Boston Rec. Area	65	-	69	69	64	66	68	B	67
11	East Boston Rec. Area	67	-	72	72	71	60	71	B	67
12	Maverick St. Residence***	54	-	54	54	52	52	55	E	52
13	Porzio Park	69	-	61	61	60	59	63	B	67
15	Waterfront Park, Edge	-	-	81	81	73	57	73	B	67
16	Waterfront Park, 90 ft from Edge	69	-	78	78	70	56	70	B	67
17	Edward Everett House	69	-	78	78	76	68	77	B	67
18	Charles River Dam Park	69	-	79	79	76	65	76	B	67
19	Stillman Place Residence***	62	-	70	70	66	<55	66	E	52
20	Casa Maria Housing***	61	-	70	70	62	<50	62	E	52
21	Quincy Market Mall	71	-	81	81	73	65	74	B	67
22A	Harbor Tower Condominiums***	59	-	69	69	58	<45	58	E	52

*See Fig. 19 of the FEIS/FEIR.

**P = Project contribution; N = Non-project contribution; TOT = Total.

***Estimated interior noise levels.

†Category B refers to sites with exterior land use, including picnic areas, recreation areas, playgrounds, active sports areas, parks residences, motels, hotels, public meeting rooms, schools, churches, libraries, and hospitals.

††Category E refers to sites with interior use only, including residences, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

TABLE 6

SUMMARY OF "SEVERE" NOISE IMPACT FOR THE PREFERRED ALTERNATIVE

Site No.	Description	Total Noise Margin Above FHWA Noise Abatement Critiera (dB)	Total Noise More Than 15 dB Above Existing Noise
1.	Rotch Playground	12	-
2.	St. Peter and Paul Church	-	-
3.	Dockside Condominiums	2	-
4.	Boston Tea Party Museum	8	-
8.	Bremen St. Residence	10	-
9.	Bremen St. Residence	10	-
10.	East Boston Recreation Area	1	-
11.	East Boston Recreation Area	4	-
12.	Maverick St. Residence	3	-
13.	Porzio Park	-	-
15.	Waterfront Park, Edge	6	-
16.	Waterfront Park, 90 ft from Edge	3	-
17.	Edward Everett House	10	-
18.	Charles River Dam Park	9	-
19.	Stillman Place Residence	14	-
20.	Casa Maria Housing	10	-
21.	Quincy Market Mall	7	-
22A.	Harbor Tower Condominiums	6	-

TABLE 7

PROJECT VIBRATION CRITERIA*

Type of Effect	Maximum Peak Vibration Velocity† (in./sec)
Damage Effects	
Structural damage	1.9
Architectural damage	
- Historical buildings	0.08
- Nonhistorical buildings	0.2
Annoyance Effects	
Hospital and critical areas	0.005
Residential/institutional/hotel	
- Construction period	0.01
- Long term	0.007
Office	0.02
Factory	0.04

*Maximum existing vibrations serve as supplementary criteria to the values listed in this table.

†Refers to ground vibration in the case of damage effects and building vibration in the case of annoyance effects.

Table 8. The actual number of potentially affected buildings and structures is determined by performing an inventory of such structures within the appropriate "impact distances" using land use maps. Assessment and mitigation of potential vibration effects for the Preferred Alternatives are described below.

2.1.1 Construction Period Effects

During construction for the Preferred Alternative, it is anticipated that some underwater blasting of rock will be required in Boston Harbor. Vibration generated by such blasting could affect nearby land use, but the potential for impacts would be limited to industrial and commercial areas near the shoreline in South Boston and at Bird Island Flats. Of particular concern in these areas are the effects of blasting on the drydock and sensitive navy vessel equipment at the General Ship facility in South Boston and on electronic equipment at the Massachusetts Technology Center at Bird Island Flats. These potential effects will be carefully evaluated during project design when detailed requirements for blasting are determined, and mitigation measures will be incorporated as required to avoid impacts. Such measures include the use of controlled blasting techniques such as the pre-splitting or line drilling of rock, use of reduced charge weights, and limiting the depth of rock removed per blast. Assessment and mitigation of vibration for other project construction activities are described below.

The most prevalent source of ground vibration during construction of the Preferred Alternative will be pile driving and slurry wall construction, with pile driving being the dominant source. In the Central Area, intermittent pile driving will occur over a one to two year period for the support of relocated utilities. Soldier piles will also be driven over a period of approximately one year in each 1,000-ft. segment of construction for site preparation, and some sheet piles will be driven for depressed ramps and tunnel crossings. The remainder of construction in the Central Area will primarily involve excavation and slurry wall construction for about one to 1-1/2 years in each section. In the North, South, and East Boston areas of the project, exposure to foundation or sheet pile driving vibration is expected to occur for periods of two to three months at nearby sensitive locations.

Maximum vibrations during construction along the existing Central Artery corridor are expected to be 3 to 20 times as great as the maximum vibrations measured at sites E through I (see Sec. 3.6.2 of the FEIS/FEIR). At site J (Spaulding Rehabilitation Hospital), maximum construction vibrations are not expected to exceed existing maximum vibrations from commuter rail operations, but would be continuous during pile driving near this location.

Potential effects of construction-related vibration include damage to structures, annoyance to people, and disruption of sensitive equipment operation. An assessment of the potential effects for pile driving and slurry wall construction is provided in the following paragraphs. Where appropriate, mitigation measures for minimizing these effects are also discussed.

Damage Effects

A review of the planned construction indicates the potential for structural damage caused by vibration at the Hanover Street Post Office and Boston Police Academy during soldier pile driving at the Sumner Tunnel portal within six feet of these buildings. Such vibration could be mitigated by pre-augering holes (before the piles are driven) in order to increase the distance of the driven pile tip from the building foundations.

During slurry wall construction, the potential for

TABLE 8

ESTIMATED VIBRATION IMPACT DISTANCES*

a. **Damage Effects**

Vibration Source	Structural Damage	Architectural Damage: Historic Buildings	Architectural Damage: Non-Historic Buildings
Construction Period			
Pile Driving	6	150	60
Slurry Wall Construction	1	18	8
Long-Term			
Elevated or Rough Roads	**	6	3
Smooth At-Grade Roads	**	2	1
Roadway Tunnels	**	**	**

b. **Annoyance Effects**

	Building Category				
		Residential/ Institutional/ Hotel			
Vibration Source	Hospital and Critical	Wooden Floors	Concrete Floors	Office	Factory
Construction Period					
Pile Driving	400	460	330	260	170
Slurry Wall Construction	160	230	80	40	20
Long-Term					
Elevated or Rough Roads	55	130	40	14	7
Smooth At-Grade Roads	13	30	10	3	2
Roadway Tunnels	**	**	**	**	**

*Table entries are distances from the source (in feet) within which vibration impact is generally expected to occur. Different distances apply in cases where impact is evaluated on the basis of a comparison of existing and project vibrations (see text).

**No impact at any distance.

structural damage exists for planned excavation within one foot of the Purity Cheese Company building in the North End and the MBTA Orange Line subway tunnel near North Washington Street. Methods for mitigation vibrations from slurry wall construction include the use of careful construction practices to avoid impacts between the slurry wall bucket and the adjacent structures.

For construction across the MBTA Red Line tunnel in Fort Point Channel near the Gillette Company, there is potential for vibration-induced structural damage during excavation around the subway tunnel. Such impact will be mitigated by strengthening this tunnel prior to construction as discussed in the Supportive Engineering Report.

For construction across the MBTA Red Line tunnel in Fort Point Channel near Summer Street and across the Blue Line tunnel at State Street, vibration levels are not expected to exceed the criterion limit for structural damage (peak velocity of 1.9 in./sec.). However, pile driving at these locations is expected to result in subway tunnel ceiling vibrations that exceed existing vibrations due to train operations. Due to the sensitive nature of these tunnels, it is recommended that vibration mitigation techniques be investigated during project design. Such techniques include water jetting and pre-excavation for sheet pile driving and pre-augering and use of low-displacement piles for bearing pile driving.

In terms of architectural damage, analysis estimates indicate that the vibration criteria for this effect would be exceeded at approximately 26 residential buildings in the North End, 23 office or commercial buildings, 15 industrial buidings, and at the Boston Garden. Excessive vibration levels at these predominantly historic buildings would result from nearby pile driving operations. Potential mitigation techniques include those methods described above. In addition, the substitution of slurry wall construction for pile driving, where possible, could also be an effective vibration mitigation technique.

It is also expected that the 0.20 in./sec. vibration criterion for architectural damage will be exceeded at the Spaulding Rehabilitation Hospital, with a maximum estimated ground vibration velocity of 0.35 in./sec. during sheet pile driving for the Leverett Circle connector ramps. However, measurements have indicated a maximum existing ground vibration level of 0.47 in./sec. due to nearby commuter train traffic, and therefore architectural damage effects are not anticipated at this building.

Annoyance Effects

In terms of construction vibration annoyance effects, it is estimated that the criteria for residential buildings would be exceeded at approximately 40 three-story residential buildings in Charlestown, 52 residential buildings in the North End, Harbor Tower, the Albany Street Apartments (South End), and at the Proposed Arts building in South Boston (259 A Street). In Charlestown, annoyance caused by pile driving vibration is expected to occur for about two to three months, with maximum vibration velocities inside the nearest residential buildings of about 0.04 in./sec., which could be characterized as "easily noticeable." In the North End, annoyance due to pile driving vibration is expected to occur intermittently over a one to two year period during utility relocation and for about one year during site preparation. Maximum vibration velocities inside the nearest residential buildings are expected to be on the order of 1.0 in./sec., which could be characterized as "very unpleasant." Note that building vibration in this area during slurry wall construction, occurring for about one to 1-1/2 years, is expected to be one-tenth as great as during pile driving, affecting about one-half as many people. At Harbor Tower, it is

expected that residents on the four lowest floors of the building closest to the Central Artery would be annoyed by vibration during pile driving for nearby utility relocation. Building vibration velocities of 0.05 in./sec. or less are expected during this operation, which could be characterized as "easily noticeable." At the Union Park/Albany Street Apartments, residents living within about 200 feet of Albany Street would likely be annoyed by vibration during pile driving for a nearby ramp. Pile driving operations are expected to occur near this location for at most two months, producing building peak velocities of 0.04 in./sec. or less; such vibration levels could be characterized as "easily noticeable." Finally, annoyance caused by pile driving vibration in South Boston is expected to occur for about two to three months in the vicinity of the Proposed Arts Building at 259 A Street. Maximum vibration velocities inside the nearest residential buildings are expected to be about 0.2 in./sec., which could be characterized as "unpleasant."

In addition to the above residential buildings, annoyance effects are anticipated for about 35 office or commercial buildings, 31 industrial buildings, and 11 institutional or hotel buildings. The latter group includes Bunker Hill Community College in Charlestown, the MDC Police Station at Leverett Circle, St. Mary's Church, the Hanover Street Post Office, Boston Police Academy, and Paul Revere House in the North End, Boston Garden, the Oliver Street Fire Station plus the Long Wharf Marriott, Bostonian and Logan Airport Hilton hotels. Annoyance effects are also anticipated at the Spaulding Rehabilitation Hospital for about two months during sheet pile driving for the nearby Leverett Circle connector ramps. Maximum building vibrations during this period are expected to range between 0.02 and 0.2 in./sec., depending on location within the building. Such levels of vibration could be characterized as "easily noticeable" to "unpleasant."

Potential mitigation techniques for alleviating the above effects include water jetting and pre-excavation for sheet pile driving and preaugering and the use of low-displacement-type piles for bearing pile driving. In addition, the substitution of slurry wall construction for sheet pile driving, where possible, could also be an effective vibration mitigation technique. Methods for mitigating vibration from slurry wall construction include the use of careful construction practices to minimize impacts between the slurry wall bucket and the ground or adjacent structures. The feasibility and effectiveness of the above mitigation techniques will depend on site-specific conditions and should be further evaluated during project design.

Effects on Sensitive Equipment

The effects of construction vibration on sensitive equipment operation are of particular concern at the Gillette Company facilities in South Boston. The results of the present evaluation indicate that building vibrations from tunnel construction are expected to be less than the maximum existing vibrations measured near sensitive equipment at Gillette. Higher levels of vibration would be expected, however, during pile driving for the supports of a temporary water intake pipe for Gillette, along the east side of Fort Point Channel. This activity would be closest to Building Z, inside which the highest existing vibrations were measured. As a result, vibrations caused by this activity would be expected to exceed maximum existing vibrations at only 2 out of 11 sensitive locations, with estimated peak velocities of 0.033 in./sec. at Gillette measurement position 10 and 0.045 in./sec. at position 11. It is anticipated that such vibration could be mitigated by the use of low-displacement piles and/or by coordinating pile driving operations with Gillette to avoid any

interference with sensitive equipment operation.

Summary

A general summary of anticipated building vibration effects for construction of the Preferred Alternative is provided in Table 9. This table indicates the approximate number and types of buildings which are expected to be subject to vibration damage or annoyance effects. Assuming a population density of 84 people per acre in the North End, and an affected area of 25 acres, it is estimated that approximately 2,100 people in the North End would be disturbed by vibration during pile driving. During slurry wall construction, this number would be reduced by about one half. Assuming that elsewhere in the project area, an average of two people occupy each residential unit, it is estimated than an additional 400 residents would be annoyed by pile driving vibration. Therefore, it is estimated that approximately 2,500 people living in the project area would be annoyed by vibration during some portion of the construction period for the Preferred Alternative. It is expected that this number could be reduced by the use of the vibration mitigation techniques discussed above.

2.1.2 Long-Term Effects

No adverse long-term (i.e., traffic) vibration effects are anticipated after implementation of the Preferred Alternative. In fact, some long-term vibration benefits can be expected after depression of the elevated portion of the Central Artery. In particular, at locations near existing Central Artery columns where traffic vibrations are now perceptible, vibrations are expected to become imperceptible after the viaduct is removed.

As no long-term vibration impacts have been identified, no mitigating measures are required.

TABLE 9

APPROXIMATE NUMBER OF BUILDINGS POTENTIALLY AFFECTED BY VIBRATION FROM CONSTRUCTION OF THE PREFERRED ALTERNATIVE

Type of Effect	Building Category				
	Hospital and Critical	Residential	Institutional and Hotel	Office and Commercial	Factory and Industrial
Structural Damage	0	0	2*	1**	0
Architectural Damage	0	26	1†	23	15
Annoyance	1††	95	11	35	31

*Boston Police Academy and Hanover Street Post Office (North End).

**Purity Cheese Company.

†Boston Garden.

††Massachusetts Rehabilitation Hospital.